ETHNIC DISPARITIES IN THE PREVALENCE OF OVERWEIGHT AND OBESITY AMONG WOMEN AND CHILDREN IN HIGH INCOME COUNTRIES: THE CASE FOR AFRICAN MIGRANT WOMEN AND CHILDREN

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ABSTRACT

Excess body weight in women of child-bearing age can have severe consequences for maternal and child health, including reduced fertility, pregnancy complications, an increased risk of child obesity and increased susceptibility to non-communicable diseases. Black women and children in high-income countries (HICs) have a disproportionately higher prevalence of overweight and obesity compared to other ethnic groups. However, there is a lack of evidence on the weight status of African migrant women and children living in HICs, and on these women's weight perceptions and perceived risks of overweight and obesity.

In the first phase of this thesis, I used systematic review, meta-analysis and framework synthesis methods to explore the weight status of African migrant women and children living in HICs, and the dietary and physical activity (PA) behaviours of African migrant women. Meta-analyses results showed that African migrant women had higher body mass index (BMI) (weighted mean difference (WMD)=1.95 Kg/m^2, 95%CI 1.16–2.75) and higher odds of overweight (OR=2.45, 95%CI 1.65–3.63), obesity (OR=2.09, 95%CI 1.41–3.12) and combined overweight/obesity (OR=2.09, 95%CI 1.41–3.12) compared to non-African women from HICs. Children of African migrant women also had higher mean birthweights (WMD=48.71g, 95%CI 4.19g–93.24g), higher odds of overweight (OR=1.50, 95%CI 1.00–2.24), obesity (OR=2.28, 95%CI 1.37–3.78), combined overweight/obesity (OR=2.08, 95%CI 1.40–3.11) and macrosomia (OR=1.83, 95%CI 1.77–1.89), and lower odds of low birthweight (OR=1.06, 95%CI 0.56–2.02) compared to children of non-African women. Risks of overweight and obesity were higher for women and children from North Africa, while data were lacking for sub-Saharan Africa. African migrant women had bicultural dietary patterns, inadequate intakes of iron, folate, and calcium, excessive sodium intakes, and reduced PA levels. There were data gaps on potential confounders that may influence maternal and child weight status, associations between maternal characteristics and child weight outcomes, and weight-related behaviours of pregnant African migrant women.

In the second phase, I explored the weight perceptions of African migrant women living in the UK, their perceived risks of overweight and obesity to themselves and their children, and the sociocultural and migration-related influences of these. Interviews conducted with 23 African migrant women from Nigeria, Ghana and Cameroon were analysed through thematic analysis. Key themes identified were: 'we are not at risk', 'bigger is better', acculturation, 'a child cannot be too fat' and infant feeding as a balancing act. The women's perceptions were influenced by their understandings and lay interpretations of body weight terms, which differed from mainstream knowledge. Perceived risk factors for obesity included: diet, genetics, childbearing and living the 'easy life' in the UK. PA was mostly interpreted as sport or exercise and was not an intrinsic part of their culture. Post-migration changes in weight perceptions included increased knowledge of healthy weight-related behaviours, awareness of unhealthy cultural practices and preference for smaller body sizes (for themselves but not their children). Pregnancy was associated with heightened weight-awareness, while preconception weight was believed to have no influence on women's health or pregnancy. Midwives and relatives were useful information sources for pregnancy weight, and challenges with weight management in pregnancy included families encouraging weight gain; food cravings; unhealthy food in the UK and unfamiliar dietary advice from midwives. Women tended to disregard weight-related advice from health care providers, while valuing advice from friends and family.

This thesis identifies African migrant women and children as high-risk groups for overweight and obesity, and highlights the role of migration and socio-cultural influences on their weight status, behaviours and perceptions. There is a need for culturally-tailored interventions to support weight management in this population, especially taking into account their multicultural identities. Further research and interventions addressing the risk factors and areas of need identified could help prevent further increases in obesity, and contribute towards narrowing the inequality gaps in health outcomes among migrant populations in HICs.

DEDICATION

I dedicate this thesis to my loving father, Dr. Ngongalah Victor, who has been my number one support, source of inspiration and role model, both personally and professionally. The origins of my interest in this PhD topic date back to about ten years ago, when I overheard some conversations (sometimes arguments) between him and my mother, and other female relatives, about a woman's weight and how to feed a child. These conversations piqued my curiosity and led me down the route of researching on infant feeding in African women which I did during my Masters, and now weight status in African women and children.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my three supervisors – Professor Judith Rankin, Dr. Nicola Heslehurst and Professor Tim Rapley, who have been a very sturdy pillar of support throughout my PhD. I appreciate their guidance in the overall conceptualization of this thesis, and their contributions of time, ideas, and constructive feedback at each stage. Judith and Nicola taught me the importance of being thorough and keeping things simple, two lessons which have shaped my thinking, research practices and writing. Thanks to them, I also had the opportunity to engage in other research projects within the Institute, which greatly enhanced my research skills and experience. Tim taught me how to think differently – *What's new about this?* He would say. *What makes it interesting?* His comments pushed my imagination beyond its limits and helped me see research in a different light. All three supervisors have been a great source of motivation, as well as encouragement during tough times. I am humbled by their dedication and hard work, and honoured to have received their words of advice, which have contributed immensely to my personal and professional growth. Both consciously and unconsciously, they have inspired my continued interest in and passion for research.

I am grateful to Newcastle University, for the financial support I received through the Newcastle University Overseas Research Scholarship. I am very fortunate to have been able to receive this award, which made my PhD a thousand times less stressful.

My profound gratitude also goes to Dr. Adefisayo Odeniyi and Zainab Akhter who took part in several stages of my systematic reviews; Linda Errington who guided me through the process of developing my search strategy; and Genevieve Hadida and Rebecca Allen, who contributed in transcribing my interviews. I cannot begin to imagine what the process would have been like without your contributions. I am additionally grateful to Dr. Adefisayo Odeniyi who never hesitated to pick my calls even on her busy days, to share her PhD-related experiences with me, which I found to be a great source of emotional comfort.

I would like to acknowledge my family, especially my parents who kept their faith in me and envisioned my successful completion of this PhD right from when I just started in 2016. I am blessed to have had your continued love, support, sacrifices and prayers. I also appreciate my siblings and friends, who understood my long silences and put up with me not responding to their calls and messages during my busy or stressful moments. Despite not always being there for you, you have been there for me and shown me unconditional love, even to the extent of planning my graduation much in advance! Your high hopes for me kept me going, and on occasions where I felt less motivated to work, your voices were a wake-up call, reminding me that I owe you all a PhD.

I am very thankful to Durell Mbanginu, who supported me in more ways than I can mention – from listening very patiently to my long rants about my 'imperfect' work, to reminding me to take breaks, and reassuring me that I am more than capable of the task. Thank you for entertaining my panic moods, forcing me to get some sleep, making sure I have some food while working and talking me out of my crazy thoughts!

I also appreciate Rawlings Niba, Zack Mute and Armand Ngankam, who on several occasions engaged in long debates with me about my PhD and challenged me with tough questions to test my knowledge. These exercises were fun and also helped me to evaluate both myself as a PhD student, and the quality of my work.

Together, you all have made my PhD journey very memorable.

I owe a great deal of gratitude to Dr. Titilope Oluwaniyi, without whom I would probably have missed the opportunity of doing my PhD at Newcastle University, meeting the wonderful people I met and encountering the lovely experiences I had. Not only did she call my attention to this PhD opportunity when it was advertised by Newcastle University, but she also followed up to ensure that I applied. She said: 'Apply Lem, I can see you doing this' – you were right, I did! Thank you.

Last but definitely not least, I would like to thank all the women who so kindly took their time to share their views with me, without which I would have had nothing to write about. I hope that this work will help shed light on some of the challenges you face with managing your weights when you live away from home, and in some way contribute positively towards keeping women like you, and their children healthy.

PUBLICATIONS, CONFERENCE PRESENTATIONS AND RESEARCH CONTRIBUTIONS

I have published one paper from this thesis (1); and presented my work at the following conferences:

- **UK Congress on Obesity, 2019 – '**Perceptions on overweight and obesity among African migrant women living in the UK'
- **5th UK Congress on obesity, 2018 –** 'Maternal overweight and obesity amongst African immigrant women living in high income countries: A systematic review'
- **5th UK Congress on obesity, 2018 – '**Overweight and obesity amongst children of African immigrant women living in high income countries: A systematic review'
- **North East Postgraduate conference, 2018 – '**Child overweight and obesity in African migrant children: A systematic review'

In 2018-2019, I co-supervised two undergraduate Nutrition student dissertations on maternal nutrition in pregnancy and perceptions on maternal and child weight. Throughout my study period at Newcastle University, I also participated in four other systematic review projects on maternal and child health, three of which have been published (2-4) and one presented at a conference (5).

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LIST OF ABBREVIATIONS

BMI – Body Mass Index

EBF – Exclusive Breastfeeding

GWG – Gestational Weight Gain

HBM – Health Belief Model

HIC – High Income Country

LBW – Low Birthweight

LMIC – Low- and Middle-Income Country

NHS – National Health Service

NICE – The National Institute for Health and Care Excellence

PA – Physical activity

PHE – Public Health England

SGA – Small for gestational age

SSA – Sub-Saharan Africa

TPB – Theory of Planned Behaviour

UNICEF – United Nations Children's Fund

UK – United Kingdom

USA – United States of America

WHO – World Health Organisation

LIST OF APPENDICES

SOME IMPORTANT TERMINOLOGIES

This section provides definitions for terms which have been used throughout this thesis.

I. Body mass index (BMI)

Weight status is determined using BMI, which is an indicator of weight-for-height, calculated as body weight in kilograms divided by the square of height in meters (kg/m^2) (6).

II. Overweight and obesity

The international BMI categories used to define overweight and obesity in adults (6) are:

- Underweight (BMI<18.5 kg/m^2)
- Normal or recommended weight (BMI 18.5 to 24.9 kg/m^2) – I use the term recommended weight in this thesis
- Overweight (BMI 25.0 to 29.9 kg/m^2) and
- Obese (BMI ≥30 kg/m^2)

BMI for children is age- and sex-specific, since their weights, heights and body composition change as they grow and develop (7). Child BMI is therefore expressed relative to other children of the same sex and age. Size and growth patterns of children are measured using BMI-for-age percentile growth charts, which were developed based on expert committee recommendations. BMI categories for children are: underweight – BMI<5^{th} percentile; recommended weight – BMI between 5^{th} to <85^{th} percentile; overweight – BMI between 85^{th} to <95^{th} percentile and obese BMI≥95^{th} percentile (8).

III. Childbearing age

The term child bearing age is imprecise, as some women can become pregnant and bear children at younger or older ages, usually anywhere between 12 and 51 years of age (9, 10). Childbearing age in this thesis refers to the ages between 15 to 45 years, as suggested by the Office for National Statistics (11). The term is also used interchangeably with ‘reproductive age’.

IV. The preconception period

Preconception health generally refers to a woman's health before she becomes pregnant. However, there is a lack of consistency in the definition and use of this term (12). This thesis uses the multi-dimensional definitions proposed in a Lancet series on preconception health (13), which cover the days or weeks before fertilisation; the weeks or months prior to a woman deciding to have a child; and the months to years leading up to a woman's first pregnancy. This is the period within which a woman's health, weight, and weight-related behaviours can influence her pregnancy outcomes.

V. Pre-pregnancy BMI

From a lay perspective, pre-pregnancy BMI may be understood as a woman's BMI before pregnancy. However, pre-pregnancy BMI is usually obtained in early pregnancy during the first trimester due to a lack of routine contact with women or BMI measurement in the pre-pregnancy period (14). Although these early pregnancy measurements may include some metabolic changes or extra weight gained after conception, weight changes during this period are shown to be minimal (15). Pre-pregnancy overweight and obesity is also referred to as 'maternal overweight and obesity' in this thesis.

VI. Migrant

The term migrant in this thesis refers to individuals who migrated from their country of origin to live in another country, doing so out of their own volition. This differs from asylum seekers and refugees who are forcibly displaced from their country of origin, usually because they are fleeing from conflict or persecution, and are seeking protection in another country (16). These terms are often used interchangeably especially by the media, as well as some research studies (17). However, it is important to note the distinction between them as it matters in this thesis. While migrants are able to safely return to their countries of origin, refugees are not able to do so (17). In addition, countries deal with migrants under their own immigration laws

and processes, while refugees are treated following both national and international laws of refugee protection and asylum (17).

CHAPTER 1. INTRODUCTION: SETTING THE SCENE

1.1. GLOBAL CHALLENGE OF OBESITY: THE STORY THUS FAR

Overweight and obesity have been described as one of the biggest public health challenges of today (18), and for good reason. From across the globe, articles have been published showing an increasing prevalence (19-23), while also detailing severe implications for individuals, populations and society as a whole (22-25). Overweight and obesity account for a large proportion of the global burden of disease, are some of the leading causes of preventable death, and have long-term consequences on health, quality of life and life expectancy (19, 20, 26). At least 2.8 million adults die from obesity-related conditions each year (18). There are also challenges with the provision of care due to the complexities of obesity-related comorbidities (27), resulting in drastic increases in healthcare cost (28).

More than 1.9 billion adults worldwide (about a third of the world's adult population) have an overweight or obese BMI, out of which 650 million have obesity (22). Similarly, 38 million children under the age of five, and over 340 million children between the ages of five and 19 have overweight or obesity (22). HICs such as the USA, the UK and Australia have the greatest prevalence (19, 20), though rates are escalating rapidly in other parts of the world, including Africa and Asia (29, 30). Concerted efforts from governments and global health agencies to halt the rise in overweight and obesity have yielded little change, and current predictions estimate that 2.7 billion adults and 70 million children will have an overweight or obese BMI by 2025, if current trends persist (31). Further increases in the prevalence of overweight and obesity translate into the worsening of health outcomes in the global population and increased healthcare costs, painting a grim image of global public health (32).

How best to address and prevent overweight and obesity at population level is clearly an important public health priority.

1.2. OVERWEIGHT AND OBESITY IN WOMEN OF CHILDBEARING AGE

1.2.1. Risk windows and opportunities for prevention

A woman's weight status – especially during her reproductive years – has important implications on her health, her reproductive outcomes and the health of her children. Throughout the life cycle, there are multiple time points which represent risk windows for the development of overweight and obesity in women and children. These include the preconception period, pregnancy, the postnatal period, infancy, childhood and reproductive age (33, 34). Ideally, conception should occur at the recommended BMI, as preconception overweight and obesity are recognised as independent risk factors for adverse health and pregnancy outcomes (35, 36). In pregnancy, overweight and obesity come with short- and long-term health risks for both mothers and children, including pregnancy complications, pre- and post-term births, congenital anomalies, cardiovascular diseases, type-2 diabetes, cancer, mental health issues and premature mortality (37-41). Excess gestational weight gain (GWG) is also associated with elevated risks of these poor outcomes, and post-partum weight retention can lead to higher weight status in subsequent pregnancies, thereby predisposing women to a repeated cycle of poor health (33, 34). Weight-related behaviours including diet and physical activity (PA) during these periods also play a crucial role in maintaining overall good health, and influence fertility, pregnancy success and reproductive outcomes (42,43).

After pregnancy, mothers (as well as fathers and other care-givers) continue to play a role in influencing their children's weights (and health) through infant feeding, and weight status in childhood is a determinant of adult weight (44-47). This means women need to be supported before conception, during pregnancy and after childbirth, to ensure the healthiest possible outcome for both themselves and their children (48). While being critical risk windows, the

above time points also present opportunities for intervention and prevention of overweight and obesity in women and children.

1.2.2. Weight status and perinatal health inequalities among Black women in HICs

Certain groups of women and children in HICs experience poorer health outcomes than others. For example, Black women (more discussion about this term in section 1.4.1. below) in the UK and USA are three to five times more likely to die during pregnancy and childbirth than White women (49, 50). They also experience higher rates of many preventable diseases and chronic health conditions such as diabetes, hypertension and cardiovascular disease (51-54). Black women have also been shown to have greater risks of poor pregnancy outcomes like stillbirths, perinatal mortality, caesarean delivery, and preterm births (55-59). Despite calls to improve access to healthcare for Black women, these ethnic disparities continue to persist (60). The reasons behind these inequalities are complex and multifactorial; however, it is well known (as described in section 1.2.1) that having an overweight or obese BMI before or during pregnancy significantly contributes to an increased risk of these outcomes (37-39, 41). According to Public Health England (PHE) (61), over 65% of Black women have an overweight or obese BMI in early pregnancy (i.e. at their first antenatal appointment), which is higher compared to women from other ethnic groups (38 to 40% in White, Asian and Mixed ethnicity women, and 16% in Chinese women) (61). Similarly, in the USA, over 75% of Black women of reproductive age are overweight or have obesity (60). The key issue is that many Black women die from largely preventable causes associated with their pregnancy and weight status.

Several factors can be attributed to the poor weight status (and consequent increased pregnancy risks) seen in Black women, some of which include biological factors, socio-cultural influences and environmental conditions which influence their behaviours, both before and during pregnancy (62-65). While some of these factors like age and genetics are fixed, behaviours are modifiable, and migration certainly has an influence on these. The relationship between migration and health is complex, and varies considerably across migrant groups (66,

67). Migration is itself a determinant of health, as it has the potential to impact the physical and mental wellbeing of migrants, their vulnerability to ill health and their health-related behaviours (68, 69). Section 1.3. looks at the relationship between migration and weight status.

1.3. MIGRATION AND WEIGHT STATUS

Several theories have been put forth to explain the relationship between migration and obesity, the most prominent ones being that HICs are obesogenic (that is, promoting weight gain or not conducive to weight loss) (70), that migrants tend to adopt behaviours that promote obesity (e.g. dietary and PA behaviours) (70, 71); and that migrants in HICs are more likely to live in precarious situations such as in deprived neighbourhoods, with less financial stability and less access to quality healthcare; all of which increase their risk of developing overweight and obesity (72-76). Migration also has important cultural implications on the weight status and related behaviours of migrants. Migrant populations come from diverse cultural backgrounds, into a new society which has its own cultural identities. Embedded in each culture is a particular philosophy of life, which permeates the social values, thinking patterns, beliefs and behaviours of that particular ethnic group (77). For example, culture influences how a particular group of people define what is an acceptable or desirable body size, and also things like what is an acceptable way of cooking, eating and socialising (78). These perceptual differences can influence the disease profiles and health risks of migrant populations, and hence, play a role on why some groups of people may be more likely to have overweight or obesity compared to others (78).

1.4. AFRICAN MIGRANTS IN HIGH-INCOME COUNTRIES

We are in an era of heightened migration, and population health issues related to migration are likely to dominate policy and political discourses for many years to come (79). International migration from Africa to HICs has increased over the years, with the top two destinations being

Europe and the USA (80). The first peak of migration from Africa to HICs occurred in 1990, followed by another in 2010 (81). According to 2017 data, Nigeria and Ghana have been major sources of international migrants from sub-Saharan Africa (SSA) to both Europe and the USA, although European countries have a more diverse set of African migrants, originating from other countries like Somalia, Senegal, Cameroon, Kenya, South Africa and the Democratic Republic of Congo (80). The driving factors behind Africans leaving their countries of origin to live in HICs vary from country to country, and from individual to individual. Some of these include seeking better educational opportunities, searching for employment and joining other relatives who live in HICs (80).

It is difficult to tell whether or how trends in migration from African countries to HICs will change in the years ahead. However, findings from a survey study (80) showed that the idea of migrating to Europe or the USA is on the minds of many Africans, especially those living in SSA. Ensuring a healthy population in HICs amidst the surge in international migration requires a coordinated and sustainable approach to identifying and addressing the needs of vulnerable groups in society (79). This needs to be supported by research evidence and data, the kind which this thesis is in a position to contribute to. While there is currently no data on what proportion of African migrants in HICs are women of child-bearing age, the predicted rise in inflow of migrants from Africa also means an increasing number of African migrant women and children in HICs.

1.4.1. Who is Black? – Classification of African populations in HICs

Ethnicity is a multidimensional concept frequently used in medical research (82, 83). It is often defined based on shared origins or social backgrounds, cultures, traditions, identities or languages (84). Its use in epidemiology and public health is crucial, as it encapsulates cultural, behavioural, and environmental factors that influence the risk of disease in populations (85,

86). As such, it is important to explicitly define the terms and concepts of ethnicity, in order to enhance understanding of research, and facilitate international comparisons.

African populations in HICs are diverse, but research on their health has not always captured this (87). For several years, African populations have been heterogeneously defined and classified using vague terms; one common example being the term 'Black' (87, 88). While it may be of significance in some dimensions (e.g. politics), its use in epidemiology and public health is not very helpful (82, 89). The term 'Black' is too broad and conceals a wide range of ethnicities and cultures (87). There is also a tendency to combine heterogeneous populations under compound labels like African-American, Black/Black-British or Afro-Caribbean (87). This is problematic because it includes both people with distant ancestry (e.g. descendants of people brought to HICs between the 17th and 19th centuries) and those with recent ancestry (e.g. people who came from Africa or the Caribbean in the 20th and 21st centuries) (87); and also those who were born in HICs and those who weren't. These groups of people are different in terms of culture, language, migration history, and certainly, health (82). In addition, people of Caribbean descent have cultural values which are different from African populations in terms of beliefs, customs, traditions and dietary practices (87, 90). Grouping heterogeneous populations together is usually done for simplicity or due to small sample sizes. However, this masks differences which may result in important health risks, behaviours and outcomes not being identified (91). This is particularly important in this thesis, as the migration experiences, cultural values and everyday perceptions of African migrant women and how these may influence their weight outcomes and weight-related behaviours are the focus of this study.

1.5. THESIS STRUCTURE

This thesis is formed of ten chapters, divided into five sections. A schematic diagram illustrating the flow of the thesis chapters is presented in Figure 1. Section one comprises of my introductory chapter (Chapter 1) which provides a background on the obesity challenge and an overview of the population of interest in this research; followed by a review of the literature (Chapter 2) on the prevalence, implications and determinants of overweight and obesity in women of child-bearing age and children. Section one ends with a rationale for this research and presents the aim and objectives of this thesis.

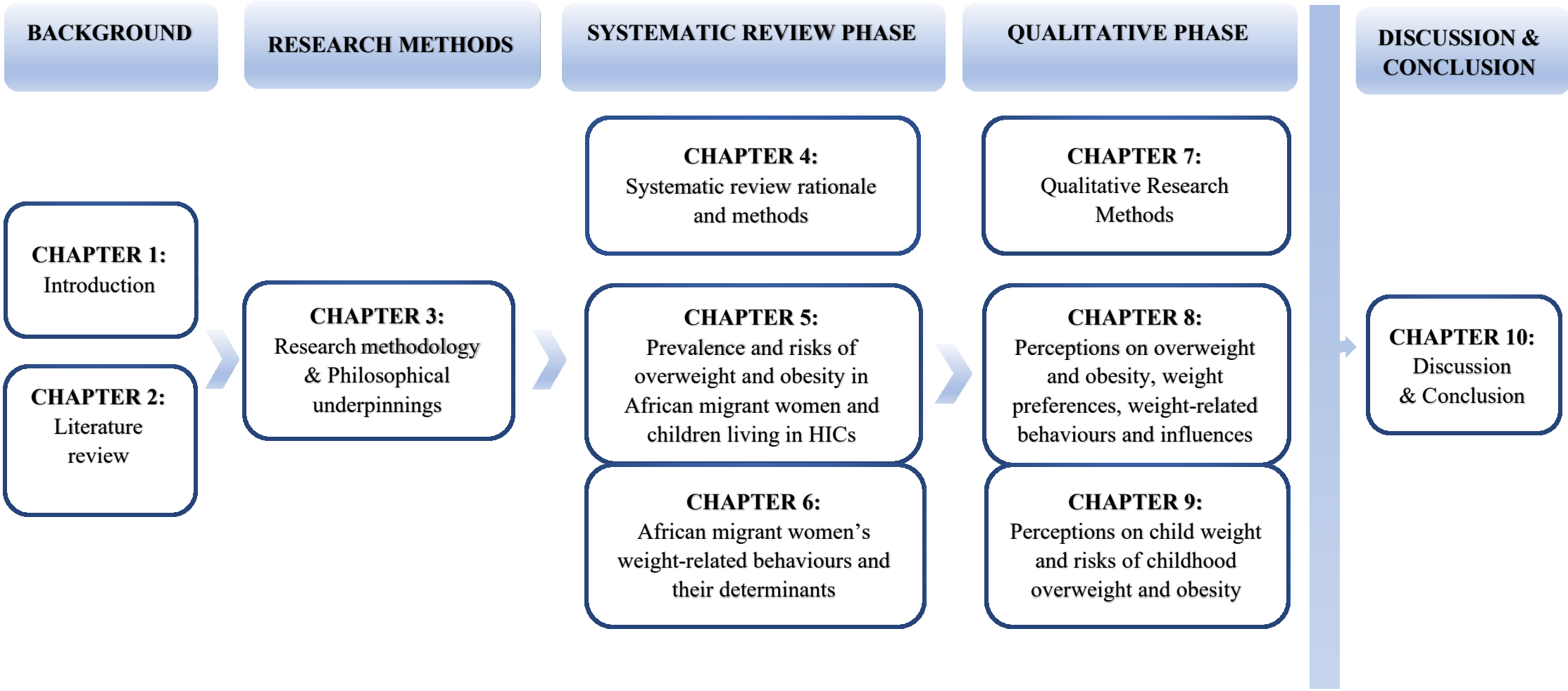
Section two (Chapter 3) provides a description of the research methodology I used, and the underlying philosophical assumptions supporting my chosen methodology.

Section three consists of three chapters covering my systematic review methods (Chapter 4) and findings on the prevalence of overweight and obesity in African migrant women and children in HICs (Chapter 5); and on African migrant women's weight-related behaviours and their determinants (Chapter 6).

Section four comprises of three chapters: Chapter 7 outlines the methods used for the qualitative phase of this research. Chapter 8 presents my findings on women's perceptions on overweight and obesity in women, and factors that influence their weight preferences and weight-related behaviours both before and during pregnancy. Chapter 9 presents my results on women's perceptions on child weight and childhood overweight and obesity.

Chapter 10 presents a general overview and interpretation of the key findings from this thesis; their implications for research, policy and practice; the strengths and weaknesses of this research and my recommendations.

Figure 1: Schematic illustration showing flow of thesis chapters



CHAPTER 2. LITERATURE REVIEW

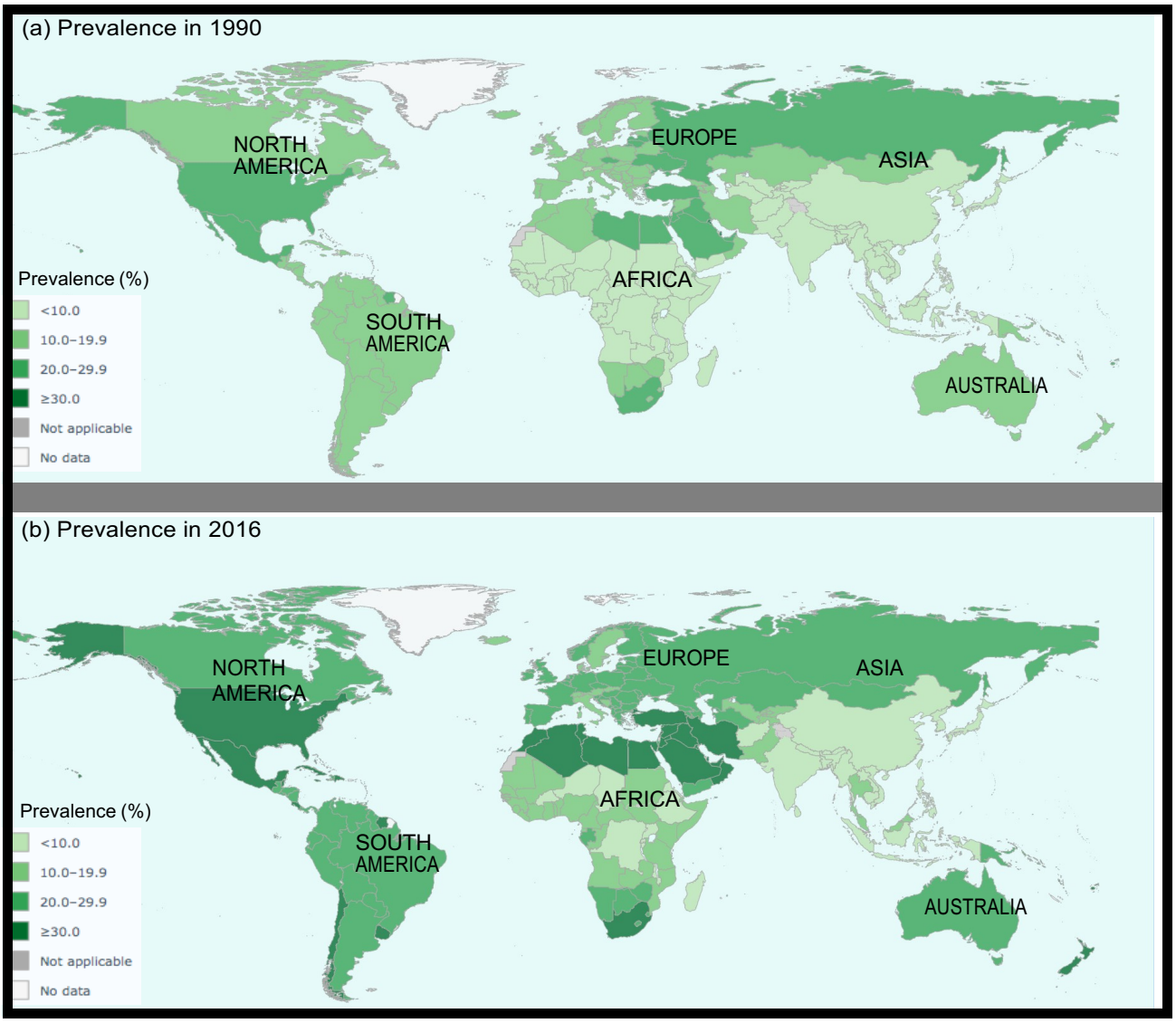
2.1. CHAPTER INTRODUCTION

This chapter provides a review of current knowledge on the prevalence of overweight and obesity among women of reproductive age and children, highlighting their influences on maternal and child health, and their associated challenges from a public health perspective. Factors contributing to overweight and obesity among women of reproductive age are addressed, including the role of migration on weight status and the rationale for African migrant women and children being a specific focus in this thesis. The chapter ends with a summary of key issues and evidence gaps identified, which form the basis for undertaking this research.

2.2. GLOBAL TRENDS IN OVERWEIGHT AND OBESITY AMONG ADULT WOMEN

Data from the World Health Organisation (WHO) (92) show that the prevalence of obesity among women aged 18 years and above has been increasing in all world regions, albeit with different increasing patterns. In 1990, the prevalence in most world regions ranged between 10 to 29.9%, except for most of Africa and South Asia where this was less than 10% (Figure 2). By 2016, the prevalence in all regions had increased, ranging between 20% to over 30%, except SSA excluding South Africa, and South Asia where some areas still had a prevalence below 10%, and others, less than 20%. According to a pooled analysis of BMI from 200 countries worldwide, there has been a mean BMI increase of 0.59 kg/m^2 per decade among adult women (93).

Figure 2: Global trends in prevalence of obesity in women aged 18 years and above between 1990 and 2016



Footnote: Image source: WHO (92)

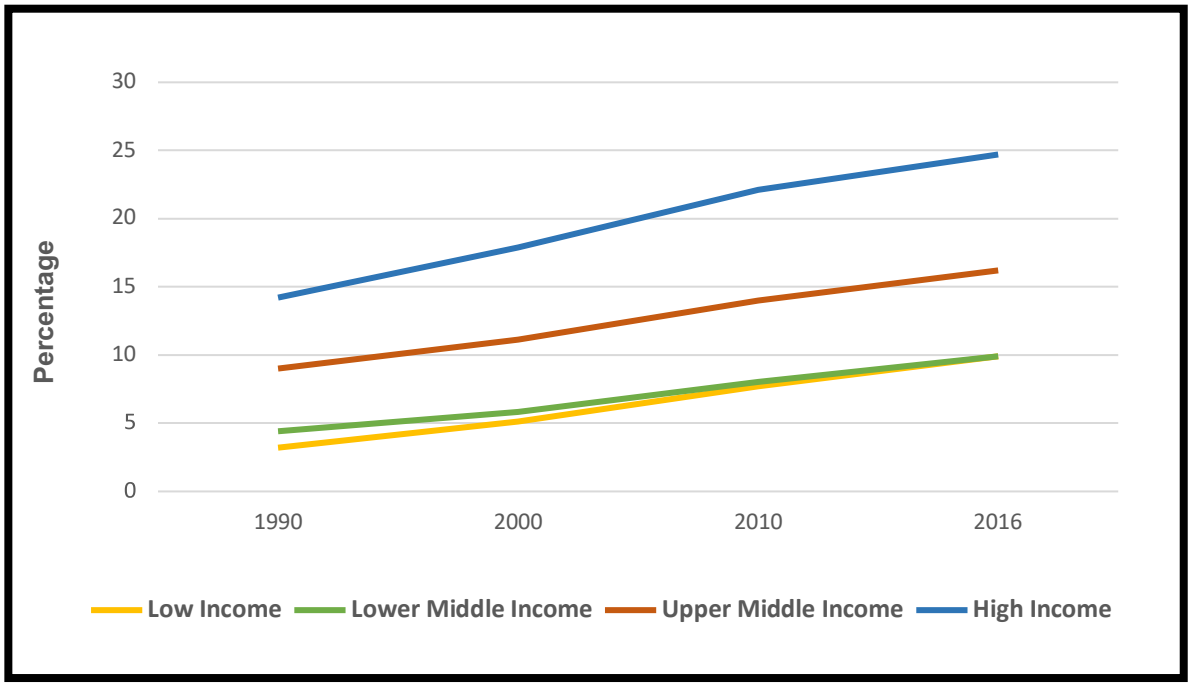
2.2.1. Trends in overweight and obesity among women of child-bearing age by World Bank income group

(i) Prevalence in High-Income Countries

HICs carry the greatest burden of overweight and obesity among adult women as shown in Figure 3, with American and European countries topping the charts (Figure 4). The current literature does not provide a comprehensive picture of the burden of maternal overweight and obesity, as most countries do not systematically report data on pre-pregnancy BMI. According to global estimates from a study that used data from the WHO, the World Bank and the Food and Agricultural Organization, the USA

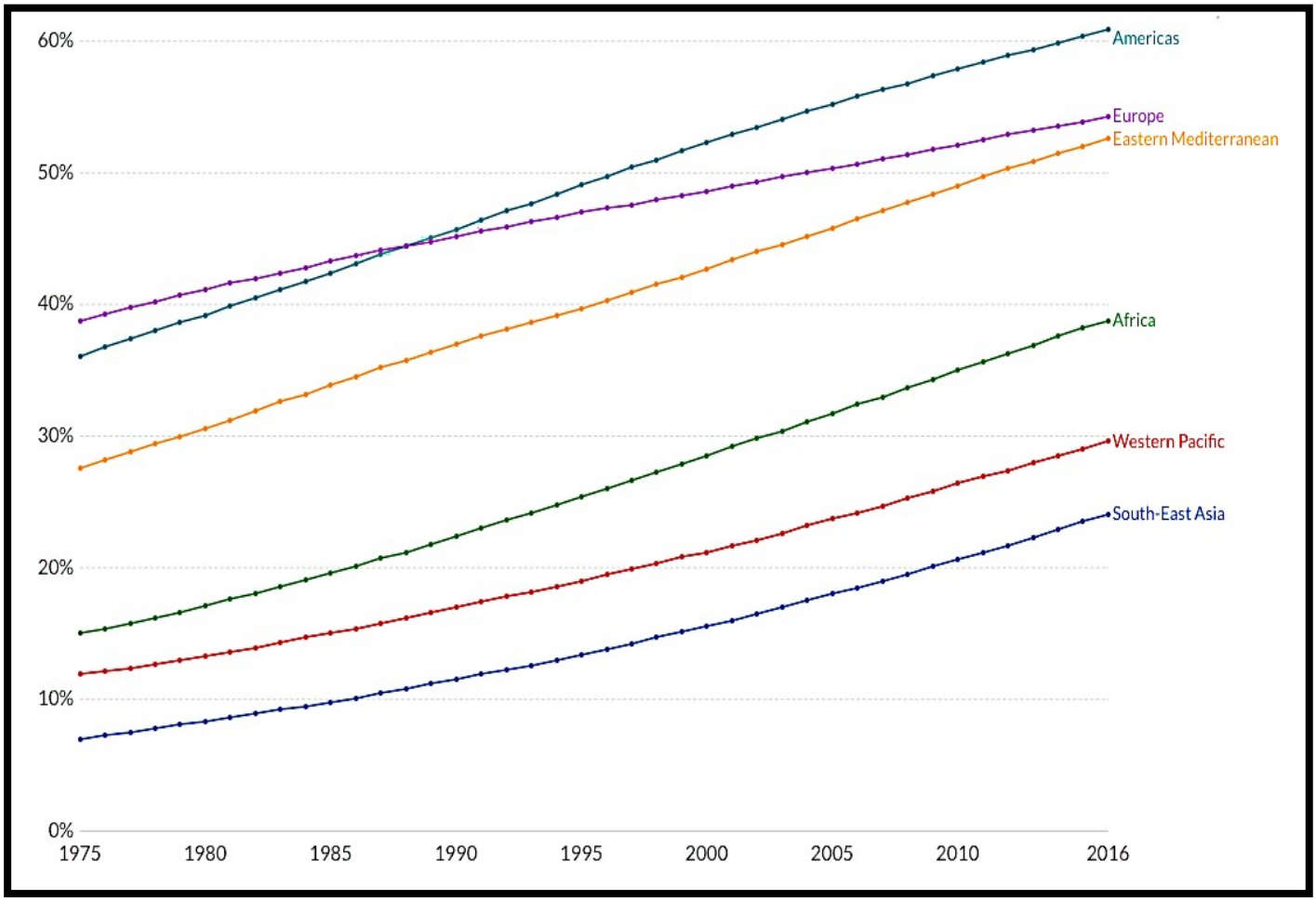
had the highest number of pregnant women with obesity out of 184 countries which were assessed worldwide (94). Statistics from the UK show that almost half of all pregnant women attending their first maternity appointment either have an overweight or obese BMI, and 1one out of five have obesity (61). In fact, obesity is becoming so prevalent in the UK that it has become one of the most commonly occurring risk factors in obstetric practice (95). In 2016, pregnant women in the UK were estimated to have the highest prevalence of obesity in Europe (25·2%) (96). While the prevalence of overweight and obesity in the USA has consistently been higher than in the UK, the rate of increase in the UK is higher (97). Similar trends are observed in other HICs such as Australia where 25.6% of women who gave birth in 2015 had an overweight BMI and 20% had obesity (98). National data on maternal overweight and obesity are not available for other HICs like Ireland, Canada, Belgium, Italy, Spain, the Netherlands and New Zealand; however, it was reported in a multi-country survey study that more than 50% of women of reproductive age in these countries have an overweight or obese BMI (20).

Figure 3: Increasing trend of obesity among adult women by World Bank income group



Footnote: Figure created using data from the WHO Global Health Observatory *(99)*

Figure 4: Prevalence of overweight and obesity among adult women between 1975 and 2016 by world region



Footnote: Figure obtained from WHO Global Health Observatory *(99)*

(ii) Prevalence in Low and Middle-income Countries

Despite having a lower proportion of adult women with overweight and obesity compared to HICs, low and middle-income countries (LMICs) have had a more rapid increase in overweight and obesity prevalence over the past two and a half decades, as shown in Table 1 (99). Estimates from adult women in India showed an increase in overweight and obesity prevalence from 0·8 million in 1975 to 20 million in 2014 (97). In Latin America and the Caribbean, almost 50% of adult women have an overweight or obese BMI, similar to statistics from some HICs (100). Meanwhile, over two-thirds of adult women in North Africa and the Middle East have an overweight or obese BMI (100), while 42% of South African women have obesity (20).

Data on the prevalence of overweight and obesity in pregnant women in LMICs are scarce. Statistics from 2000 to 2015 showed that obesity rates among pregnant women in Africa ranged from 0.7% to 26.8% (97). In countries with high birth rates, the prevalence of overweight and obesity among pregnant women was seen to have doubled between 2005 and 2014 (94). These trends were seen in countries like Nigeria (96.9% increase), the Democratic Republic of the Congo (102.2%), and Tanzania (111.6%) (94). Findings from a systematic review in 2015 showed that maternal obesity levels in some African countries were also comparable to those in HICs, based on BMI measured in the first trimester (101).

Table 1: Percentage increase in overweight and obesity among women of child-bearing age by income group

Income group	Prevalence (%)		Percentage increase (%)
	1990	2016	
High-income countries	14.2	24.7	73.9
Lower-middle income countries	9.0	16.2	80.0
Upper-middle income countries	4.4	9.9	125.0
Low-income countries	3.2	9.9	209.4

Footnote: Data source - WHO Global Health Observatory (99)

Most LMICs are facing a dual burden of disease due to the coexistence of under- and over-nutrition, and a rise in both infectious and noncommunicable diseases (102, 103). However, though many parts of Africa and South Asia still have high rates of malnourished women with underweight BMIs, excess weight is more common than underweight among women of reproductive age (20, 104, 105). Overweight and obesity among pregnant women is considered an emerging major public health issue in Africa, and approximately one in four maternal deaths in SSA results from medical conditions related to obesity, such as gestational diabetes, hypertension and pre-eclampsia (101).

2.3. GLOBAL TRENDS IN CHILDHOOD OVERWEIGHT AND OBESITY

Similar to adult trends, more children worldwide are developing overweight and obesity (106, 107). Approximately 20-30% of school age children in European countries (108) and 30-40% of children in the American and Eastern Mediterranean regions had an overweight or obese BMI in 2014 (32). The UK has one of the highest levels of childhood obesity in Europe, with almost one in five children having overweight or obesity when they start primary school, rising to one in three by the time they start secondary school (109, 110). Similar findings have been reported in the USA, where approximately one in five children have obesity, and significant increases were observed in children aged two to five years between 1999 and 2016 (111). In other HICs like Canada, 30% of children aged five to 17 have overweight or obesity (112), while in Australia, 25% of children in the same age group have overweight or obesity (113).

The largest global increases in the number of children with overweight and obesity have occurred in LMICs, specifically in East Asia, the Middle East and North Africa (114, 115). Nearly half the number of under-fives who were overweight or had obesity in 2014 lived in Asia, while the number of children with overweight and obesity in Africa nearly doubled from 5.4 million in 1990 to 10.6 million in 2014 (22). Child malnutrition remains pervasive in LMICs; and at the same time, children in these countries are exposed to energy-dense foods which tend to be lower in cost, but also lower in nutrient quality (116, 117). These children are therefore vulnerable to inadequate prenatal, infant, and young child nutrition (116, 117). Childhood obesity levels in some LMICs have risen to levels similar to those in some European countries, and it is common to find undernutrition and obesity co-existing within the same country, community or even household (116).

2.4. DEBATES SURROUNDING THE PREVALENCE AND ASSESSMENT OF OVERWEIGHT AND OBESITY

There is some evidence suggesting that the prevalence of obesity in both children and adults (especially women (118, 119)) may be plateauing or levelling off in some HICs (118-124). However, these findings have been contested, based on methodological flaws and alleged misinterpretation of epidemiological data (125, 126). Visscher *et al.* (126) found that BMI levels at the upper end of the weight distribution have continued to increase, and also, that changes in abdominal obesity have not been accounted for in these analyses. When waist circumference measurements were taken into account, abdominal obesity levels increased even when BMI-defined obesity did not increase. Moreover, studies reporting the slowing down of overweight and obesity have typically observed these changes in 'relatively short periods of time', whereas from a historical perspective, these short- term plateaus or decreases have always been followed by further increases (126, 127). Trends in the prevalence of child obesity have also been shown to vary by socioeconomic status (SES), decreasing in areas with high SES populations and increasing in low SES areas (128-130). This implies that the data on stabilising obesity rates may conceal increasing obesity-related inequalities.

Further critiques have been made regarding the interpretation of data describing changes in average body weight, and the appropriateness of language used to describe the extent of these changes. Terms like 'epidemic' and 'pandemic' have been referred to as 'alarmist', and it has been argued that describing obesity trends as 'doubling' or 'tripling' does not reflect actual changes in body weight over time (127, 131, 132). These arguments are mainly supported by the fact that weight gain has not occurred universally across the weight spectrum (127, 132), and also the inaccuracies resulting from using the BMI as a measure of obesity. The adoption of the BMI as 'gold standard' for assessing weight status is largely thanks to it being an easy, cheap and non-invasive technique, which allows for weight to be standardised according to height, thus enabling comparison across people of different heights (133). It is however, increasingly being recognised to be a poor index of adiposity (133-137). A particular problem with the BMI is that it does not account for body fat distribution, or distinguish

between fat and muscle mass, which tends to be heavier (134, 135, 138). This implies that athletes or muscular individuals could easily be wrongly classed as overweight or obese.

BMI also does not correspond to the same degree of body fat in different populations, as levels could be altered by factors like age, sex, activity and ethnic origin (134, 139). For example, different BMI categories have been developed for Asian populations (140), due to a higher body fat percentage and higher health risks than White populations of the same age, sex and BMI (140, 141). Studies have also revealed that body fat may be distributed differently in White and Black populations; for example, Black women are shown to have lower visceral adipose tissue than White women for a given BMI, waist circumference, or waist-to-hip ratio (142-145). Women also generally tend to have a lower BMI than men in population-based studies, despite having a greater fat mass relative to their body build (133). These findings suggest that the BMI systematically either over- or under-estimates adiposity in some groups, thereby warranting caution when making interpretations in relation to health risks in different populations.

Other methods for assessing adiposity exist, such as waist circumference, skin thickness, bioelectrical impedance analysis and hydro-densitometry (146). However, these are not widely used because they are either impractical, expensive or difficult to measure accurately across large populations (146). Another alternative is the waist-to-height ratio, which is described as an accurate and easy-to-use measure of obesity, and is shown to work well regardless of age, sex and ethnic group (147). Yet, despite its known limitations, BMI continues to be the ‘go to’ tool due to its simplicity and widespread adoption.

Despite all the arguments, it is evident from current literature that the prevalence of overweight and obesity has increased over time, and is well over expected population levels. From a public health perspective, this is consistent with the definition of an epidemic.

2.5. CONSEQUENCES OF OVERWEIGHT AND OBESITY IN WOMEN OF REPRODUCTIVE AGE

2.5.1. Maternal health impacts

The consequences of overweight and obesity in women of child-bearing age are manifold. Overweight and obesity in women reduces fertility, increases time taken to conceive, and increases the risk of obesity-related comorbidities such as type 2 diabetes and hypertension (41, 148-150). Women who enter pregnancy with an overweight or obese BMI have a heightened risk of adverse perinatal outcomes including early pregnancy loss, premature birth, gestational diabetes, gestational hypertension, pre-eclampsia, caesarean delivery, preterm delivery, having a large-for-gestational-age baby, as well as small-for-gestational age babies (37-39, 41, 97, 151, 152). They are also more likely to experience complications during labour and delivery, post-partum haemorrhage and weight retention; resulting in an increased body weight before subsequent pregnancies (40, 152-155).

There are no standard weight gain recommendations that apply to every pregnant woman (156). Some HICs such as the USA and Canada provide GWG guidelines for pregnant women (Table 2) (157, 158). Women who gain weight outside these recommended ranges are susceptible to pregnancy complications such as caesarean delivery as a result of having a big baby, and increased weight retention after pregnancy (159-162). The UK has no national GWG targets. Current guidelines require that maternal weight and height be measured at first appointment, but not routinely throughout pregnancy (163). While pre-pregnancy BMI is a good indicator of maternal overweight and obesity, it does not account for early GWG, which itself predicts some maternal and child health outcomes, such as post-partum weight retention and childhood adiposity (164, 165). It is also common in clinical practice to ask pregnant women to self-report pre-pregnancy height and weight. This approach is problematic, as it can systematically underestimate overweight and obesity levels in pregnant women (166-169); although some evidence finds that the difference between self-reported and measured values is negligible (170).

Table 2: Gestational weight gain reference ranges (Canada and USA)

Pre-pregnancy BMI Category	BMI Range	Recommended Total Weight gain (Kg) - US references	Recommended Total Weight gain (Kg) – Canadian references
Underweight	Less than 18.5	12.7–18.1	12.5–18
Recommended weight	18.5–24.9	11.3–15.9	11.5–16
Overweight	25–29.9	6.8–11.3	7–11.5
Obese (all classes)	30 and greater	11–20	7

Footnote: Data sources *(157, 158)*

2.5.2. Child health consequences

Children born to women who are overweight or obese are more likely to have higher birthweights than children born to women who are not overweight or obese, leading to an increased risk of overweight and obesity in both childhood and later adult life (171, 172). This means maternal obesity compromises the wellbeing of the next generation by creating an intergenerational passage of obesity risk (4, 173). Maternal obesity increases the risk of pre- and post-term births, stillbirths, congenital anomalies and premature deaths in children (37, 174-177); and also predisposes children to psychological problems such as depression, low self-esteem and poor cognitive skills (178, 179).

The mechanisms through which maternal obesity is associated with unfavourable consequences for the offspring are complex and multifactorial. Some studies suggest that obesity in pregnancy results in an overabundance of nutrients crossing the placenta, which influences fetal metabolism, leading to physiological changes in childhood (179, 180). It is also recognised that the development of the fetus may be altered by the *in-utero* environment as a result of fetal programming, resulting in permanent changes in childhood, which could endure into adulthood (181). Other possible mechanisms include genetic alterations in the gut microbiome, and changes in DNA methylation (182). Maternal obesity is also associated with placental insufficiency, whereby there is a limitation in blood flow and nutrients crossing the placenta, resulting in fetal growth restriction and subsequently, small-for-gestational age (SGA) babies (183). SGA babies face a high risk of staying longer in intensive care and developing

feeding difficulties, as well as neonatal morbidities like jaundice and sepsis (183, 184).

2.5.3. Maternal obesity and infant feeding

Early infant feeding is an important determinant of children's health and weight status (45, 185). The WHO recommends that women introduce breastfeeding within an hour of birth; that infants be breastfed exclusively for the first six months of life (breastmilk only without any other solids or liquids including water, except for medications); and that breastfeeding be continued beyond six months, accompanied by nutritionally adequate semi-solid or soft foods (186). Breastfeeding promotes optimal weight gain in infants, and reduces the risk of childhood obesity (187-190). This risk reduction is related to the exclusivity and duration of breastfeeding, as well as the timing of introduction of supplemental baby foods (188, 191, 192). The risk of obesity in infants breastfed exclusively for at least 6 months is reduced by at least 10-20%, compared to children who receive supplemental foods earlier (191, 192). Meanwhile, not breastfeeding at all, breastfeeding for less than 6 months or introducing solid foods before the age of 4 months are all shown to increase the risk of child obesity (188, 193-195).

Maternal obesity has been shown to correlate negatively with breastfeeding success; and several studies have demonstrated a decreased breastfeeding intention, decreased initiation rates and decreased breastfeeding duration among women with obesity compared with recommended weight women (189, 196-198). The reasons for poor breastfeeding outcomes in women with overweight or obesity are multifactorial, including challenges with positioning to establish breastfeeding (199), reduced milk supply due to metabolic and hormonal changes (200) and lower prolactin response to suckling (195, 201, 202). Some of these factors may also be cultural or psychological, having to do with body image, lack of confidence, or discomfort related to breastfeeding in front of others (203, 204).

Despite the mounting evidence lending support for breastfeeding, debate continues to linger over whether breastfeeding protects against childhood obesity, partly because studies have not

consistently demonstrated this relationship across ethnic groups (205-207). In addition, findings largely rely on observational data, whereas randomised controlled trials which are usually ranked higher cannot be carried out as withholding breastmilk from babies is unethical (208). Some researchers are also of the opinion that looking into existing studies on the effects of breastfeeding on child health and development brings up more questions than answers, because results often vary depending on the population under study, the age at which outcomes are measured, how breastfeeding is defined, and what potential confounders are taken into consideration (209). The relationship between breastfeeding and child obesity may also be unclear because both outcomes can be influenced by socioeconomic and cultural factors. However, breastfeeding has many proven health benefits for both infants (e.g. strengthening child immunity, protecting from common childhood illnesses, enhancing child growth and cognitive development) (185, 190, 210) and mothers (e.g. enhancing bonding, protecting mothers from breast and ovarian cancer) (190, 210). Breast milk also offers infants the most nutrient-rich form of nourishment that is important for their growth and development (186, 188). The recommendations on early infant feeding are clearly meant to promote the health and wellbeing of mothers and their children, and optimal early infant feeding should therefore be promoted regardless of its relationship to childhood obesity.

2.5.4. Public health implications of overweight and obesity in women and children

Increases in overweight and obesity among women of reproductive age means there will be high rates of miscarriages, fetal anomalies, type 2 diabetes, blood pressure problems and delivery complications (36, 95, 180). These put strain on maternity services, resulting in a greater demand for health professionals and an increased need for resources and appropriate facilities to manage these complications (95). The cost of healthcare also increases drastically, with increased use of health services for obesity- related causes, which range from labour inductions and caesarean deliveries to longer hospital durations and extended antenatal care (211, 212). There are also adverse social impacts associated with obesity, such as discrimination, social exclusion and unemployment, which can in turn result in the widening of inequalities in health and social care (213). Such inequalities put people at a disadvantage by limiting their chances of living healthier or longer lives. At societal level,

overweight and obesity bring challenges for families and communities, and can considerably reduce quality of life and life expectancy (27, 214). Thus, taking steps to address the burden of overweight and obesity in women of child-bearing age is a public health priority. Supporting good maternal health especially around conception and in pregnancy also sets the foundation for promoting child health and giving babies the best start in life.

2.6. MIGRATION AND OBESITY

Migrating to start life anew elsewhere - whether voluntarily or involuntarily - requires an almost complete realignment of daily life. Migration changes both the living and food environments of an individual, and influences factors that might shape overweight and obesity risks. For example, migration influences the wider determinants of health, including education, occupation and SES; and also influences health behaviours (69, 215, 216). Migrants living in HICs are generally reported to be more vulnerable to adverse health conditions like cardiovascular disease, poor mental health, type 2 diabetes and perinatal morbidity compared to non-migrants (217-222). While the reasons for these differences are multifactorial, it is important to recognise factors that can promote good health in aboriginal communities, such as strong connections to the country and community, strong social networks and strong networks of care. The absence of such protecting factors, in addition to the often-challenging process of integrating into a new country contribute to migrant vulnerabilities to poor health.

2.6.1. Theories explaining the relationship between migration and body weight

Several studies from HICs have found a positive relationship between migration and obesity (67, 71, 223-226) and various theories have been put forth to explain this relationship:

(i) Exposure to obesogenic environments

This theory proposes that HICs to which migrants migrate are usually obesogenic, that is, have a high availability of unhealthy foods, limited access to affordable healthy food options, and daily life activities tend to be sedentary (225, 227, 228). As such, the longer migrants stay exposed to these conditions, the more their weight increases. Theorists believe that migrants' body weights increase overtime,

becoming similar to those of the host populations, which usually have high rates of overweight and obesity (225, 227, 228).

(i) Dietary acculturation

This theory focuses on how migrants' lifestyles and behaviours change after migration. According to this explanation, migrants usually adopt new and 'less healthy' dietary behaviours after migrating to a HIC, resulting in changes in food intake, food quality and cooking methods; and an increased consumption of energy-dense foods (223, 229-231). These changes usually occur as migrants integrate into the host country and assimilate in terms of language, jobs, and social norms; in the course of which they also adopt ideas, values, and behaviours that are different from their former lifestyles (70, 232). As the dietary behaviours adopted are often ones that promote weight gain, migrant body weights and obesity rates become similar to – or even higher than – those of native-born populations overtime (223, 227). Studies from various HICs have found positive correlations between dietary acculturation and obesity (70, 233-235).

(i) Duration of stay in high-income countries

A 'healthy immigrant effect' has been documented in various HICs, where immigrants arrive healthier than native populations (71, 236). However, this health advantage tends to dissipate over time, and the health status of immigrants becomes similar to or worse than that of the local population (71, 236). This trend has been reported for obesity and type 2 diabetes (236-238). However, evidence in support of the healthy immigrant effect has not been consistent across countries and ethnic groups, and it does not occur for all health indicators (239-241). Several explanations have been put forth as to why immigrants may be healthier upon arrival at HICs, including: enhanced pre-migration health screening processes (66); immigrants possibly coming from healthier or wealthier parts of their countries (referred to as immigrant self-selection) (242); or inaccuracies in self-reported health conditions upon migration either due to under-reporting, differences in health perceptions or because they have not yet been diagnosed (243).

(ii) Pre-migration exposures

Researchers have explored the role of pre-migration exposures on migrants' body weights, by considering obesity levels in the countries of origin of migrants. This theory suggests that some migrants may be arriving with already high body weights, as a result of migrating from places where obesity rates are high (e.g. North Africa) (244). Thus, their weights are reflective of the weight status of populations in their countries of origin, rather than being as a result of their new environments (224).

(iii) Deprivation

An additional consideration with respect to migrants' countries of origin pertains to people migrating from areas where there are high levels of deprivation, as migrants from such places may be underweight on arrival, due to experiences of deprivation (245). However, because their metabolic systems are programmed for scarce nutritional environments, their bodies are not well prepared to handle the calorie-rich foods they become exposed to in HICs (246, 247). Hence, they are more likely to experience rapid increases in weight status and other related chronic diseases (246, 247).

(iv) Stress related to the migration process

Finally, some researchers have reported that the high levels of stress from preparing to migrate, being in transit, and getting established in a new place may contribute to weight gain, and also promote unhealthy coping strategies, such as stress-induced eating, which may lead to obesity (66, 67). In addition, migrants may have limited knowledge of where to find the healthy resources they need during the early stages of resettlement (66, 70).

2.7. SOCIO-CULTURAL PARADIGMS ASSOCIATED WITH WEIGHT PERCEPTIONS AND BEHAVIOURS

In all human societies, body size is imbued with cultural meaning, and what people consider ideal or desirable varies profoundly. Some parts of the world – particularly the West – have a general preference for lean body size, while bigger body size is considered undesirable, both socially and

health-wise (248). Individuals also have personal perceptions of how their bodies should be, and these are often influenced by general societal norms. Young women in Western societies are often concerned about their body image, most considering themselves 'too fat', due to pervasive cultural ideals of female thinness, societal concepts of an ideal degree of fatness and stigma associated with overweight (249). The thin ideal is also an idea promulgated by the media and reinforced by the fashion industry (250). The social consequences of being 'too fat' are often severe, some of which include bullying and discrimination (251, 252).

In sharp contrast, other parts of the world, such as many African countries, have historically been 'fat-positive', that is, demonstrating a preference for bigger body size (253-255). There are high cultural values placed around size and weight in these countries and being 'fat' is thought to represent success, wealth and good health (253, 254). For women, this is also a sign of attractiveness, fertility, marriageability and happiness (253, 256). Big body size also characterises high social status and power (257). Several factors may have contributed to this weight preference. African countries - especially those in SSA, are known for high levels of undernutrition, natural disasters, population displacement and, in some parts, chronic poverty (258-260). Continuous exposure to such adverse conditions may have influenced the way body weight is socially constructed and positioned. SSA is also known for a high prevalence of HIV and AIDS (261), and weight loss or small body size are believed to be symbolic of the disease (253, 262).

It is also important to consider socio-cultural influences on women's PA behaviours. Women in HICs grow up in a society where it is common to find other women talking about exercise, coming together for the purpose of exercise or participating in outdoor activities like running, swimming, cycling or going to the gym, which may motivate other women to participate (263, 264). In addition, there are several motivational factors like high exposures to messages about the health benefits of PA, the availability of sports facilities and, recently, national programs like the 'this girl can' campaign in the UK which aims 'to get women and girls moving, regardless of shape, size and ability' (265, 266). On the other hand, women in African countries are mostly engaged in domestic chores or care-giving

roles for other family members, with limited time to participate in PA-related activities (267, 268). Some African cultures restrict women's participation in outdoor activities or require that they obtain permission from senior members of the household before engaging in them (269). In some cultures (e.g. in Muslim communities), women have to dress conservatively, or be chaperoned in public spaces, which limits their ability to engage in outdoor activities (270). However, this is not to say that PA levels of women in African countries are below recommended ranges, as they may already be engaging in physically-demanding activities daily, like farming and other occupational activities.

2.7.1. Transitioning from an African country to a high-income country, and influence on weight status – '*a taste of both worlds'*

A famous African poet (Niyi Osundare) once said: 'When two cultures meet, they kiss and they quarrel' (271). This quote conceptualises the fact that there are both shared similarities and areas of divergence between disparate cultures. Women who migrated from an African country and are now living in a HIC have experienced life in both settings. On arrival, they bring with them the health beliefs, traditions, and cultural practices of their home countries. Over time however, they go through the process of adapting to their new environments while trying to balance between the beliefs and practices from their home countries and those in the new one (79). As described in section 2.6, the process of integration can have important consequences on one's weight status (70).

One example of how migrant behaviours can change after migration relates to smoking, which is one of the known risk factors for obesity. In a typical African setting, smoking is frowned upon or considered unacceptable among women; even more so during pregnancy (272). Thus, not surprisingly, African migrant women in HICs show lower levels of smoking compared to non-African women (273). However, studies have shown an increase in the prevalence of smoking among African migrant women overtime, including in pregnancy (273-275). These changes could be as a result of weaker normative restrictions towards these behaviours in HICs, or other factors like environmental influences or greater access to tobacco and alcohol (273-275). Another example is how migration may have an influence on women's PA behaviours in pregnancy. A study reporting on global trends in PA between 2001 and 2016 showed that women from HICs had a higher prevalence of physical

inactivity (43%), more than twice that in women from SSA (17.9%) (268). Meanwhile, studies have consistently found low levels of PA in African migrant women, some even lower than that in women from HICs (264, 276, 277). These findings show how the process of transitioning from one setting to another could influence the adoption of behaviours that contribute to overweight and obesity.

2.8. EVIDENCE GAPS AND STUDY RATIONALE

2.8.1. Prevalence of overweight and obesity in African migrant women and children

It is evident from current literature that Black women in HICs have higher risks of overweight and obesity. However, there is no clear evidence that accounts for the role of migration on the risk of overweight and obesity among Black women in HICs, as studies do not distinguish between Black women who were born in HICs and women who migrated from African countries to live in HICs. This is an important gap because, as described in Chapter 1 section 1.4., migration has the potential to impact the physical and mental wellbeing of migrants, their vulnerability to ill health and behaviours that can contribute to their risk of developing overweight and obesity (68, 69). It is therefore important to consider women's migrant backgrounds when exploring trends in overweight and obesity in HICs.

Similarly, studies combine weight outcomes in children whose parents were born in HICs with those of migrant populations. The factors that influence weight status in children of migrant populations may also be different from those whose parents were born in HICs. Children's food environments, weight-related behaviours and obesity risk are largely driven by parental behaviours and preferences (67, 278). Studies report that migrants are usually keen on preserving their cultural identities after migration, and also try to ensure their children do not replace their traditional values with 'foreign' ideas (78, 279). However, this is often a challenge for children who are constantly straddling two distinct behavioural and cultural patterns, trying to make sense of both. Younger children tend to 'reject' their parents' customs as they assimilate in schools and interact with friends from HICs, while older ones forge dual identities (279). The extents of these events vary with migrant background and have implications on children's weights. Thus, migrant background is an important factor to consider when assessing trends in childhood overweight and obesity in HICs.

2.8.2. Perceptions on body weight and risks of overweight and obesity in women and children

There is a large body of evidence documenting body size preferences in Black women living in HICs. They are shown to have larger body size ideals, to be more likely to under-estimate their body weights and to generally experience less body dissatisfaction than other ethnic groups, despite having higher weights (280-285). However, only a few studies have explored the factors that influence how Black women's perceptions of their bodies are formed (284, 286-288). In addition, studies have not differentiated between perceptions of migrant and non-migrant women, or Black women from different parts of the world (e.g. African and Caribbean women). A systematic review of African migrant women's weight perceptions found that women who had migrated from North and South African countries to live in the UK, Italy and the Netherlands showed preference for smaller body sizes and desired to lose weight (289). This suggests that the general trend of under-estimating and preferring bigger body sizes may not be the same among migrant women. Studies on women's weight perceptions are also lacking for migrant women from SSA.

Health-related perceptions play an important role in shaping health behaviours and the formation of these perceptions have important consequences for health. How women perceive the health implications of overweight and obesity may influence their weight preferences and weight-related behaviours both before and during pregnancy. Just as their perceptions on child weight and the risks of child overweight and obesity, and preventive factors like breastfeeding, can also determine their infant feeding decisions. To be able to develop culturally appropriate strategies for prevention of overweight and obesity in African migrant women, a better understanding of the sociocultural and migration-related influences on their weight perceptions is needed. This understanding will aid in identifying challenges, as well as opportunities for taking action to address the increasing public health challenges relating to preventing overweight and obesity in this group of women and children, and prevention for future generations.

2.9. RESEARCH AIMS AND OBJECTIVES

My PhD had two overarching aims. The first aim was to synthesise the available literature on the prevalence and determinants of overweight and obesity among African migrant women and children living in HICs. The objectives were:

(i) To compare the prevalence of overweight and obesity in African migrant women with that in non-African women from the host HICs

(ii) To compare the prevalence of overweight and obesity in children of African migrant women with that in children of non-African women from the host HICs

(iii) To explore African migrant women's weight-related behaviours after migration and their determinants

The second aim was to explore UK-based African migrant women's perceptions on weight status, weight-related behaviours and the risks and implications of overweight and obesity to themselves and their children. This was achieved by exploring the women's perceptions of:

(i) Their current and desired body weights, the current and desired weights of their children, and factors influencing these preferences

(ii) Their perceptions of the risks of overweight and obesity in women of child-bearing age and in children

(iii) Their weight-related behaviours including changes after migration and factors influencing these

(iv) Their weight management behaviours during pregnancy, including barriers and facilitators for having a healthy weight

CHAPTER 3. RESEARCH METHODOLOGY AND PHILOSOPHICAL UNDERPINNINGS

3.1. CHAPTER INTRODUCTION

This chapter presents an overview of the philosophical theories underpinning this thesis, followed by a discussion of the research paradigms adopted and the rationale for the research methodology used.

3.1.1. Ontological and epistemological positions

A paradigm can be understood as a set of beliefs that represent a worldview (290). Research paradigms are philosophical assumptions that determine the approach taken to understand and address a research problem (291). The rigour of any given research relies on an alignment between its underlying assumptions, the research question, and the methods used (291). In other words, a research paradigm informs the choice of methodology, data collection, and data analysis (292). I review below, some fundamental terms used in the philosophy of scientific research, and outline how these informed my study methodology:

3.1.1.1. Ontology – the theory of being

Ontology is a branch of philosophy that studies the existence of things, and how things that exist relate to each other (293). It is concerned with assumptions made about the nature of the world, and what we can know about it (294). Simply put, ontology deals with the study of reality – that is, what is, what exists or what is possible.

Broadly speaking, there are three distinct ontological positions, which are realism, idealism and materialism (295). The realist philosophy claims that reality exists independent of human thinking or understanding. Idealism, on the other hand, asserts that reality is mind-dependent and can only be

understood through human understanding and socially constructed meanings; while materialism claims that reality results from material interactions, and is not shaped by ideals, beliefs, values or experiences (295).

3.1.1.2. Epistemology - the theory of knowing

Epistemology deals with the study of knowledge; that is, what constitutes knowledge (what we can know) and how knowledge can be created, acquired and communicated (how we can know it) (296). It is a concept that embodies an understanding of how we look at the world and make sense of it (295). Two core epistemological perspectives are positivism and interpretivism (297-299).

The positivist theory posits that knowledge is based on natural phenomena, and that knowledge is observable and quantifiable (297). Positivists argue that reality is objective, and so the researcher aims to derive context-free generalisations by using structured and logical approaches (298). This means positivists detach their personal beliefs and judgements from the investigated phenomena in order to avoid bias, and make conclusions based on deductive logic and empirical observations (297). The positivist researcher uses methods based on direct observation, such as hypothesis testing, causal explanations and modelling (297).

The interpretivist theory rejects the positivist assumptions, and emphasises that analyses need to be context-based (294). Interpretivists argue that reality is socially constructed, and that knowledge is obtained by exploring and understanding phenomena (294, 299). In this case, the researcher adopts a more flexible approach to capturing meaning and making sense of what is perceived to be reality (298, 300). The interpretivist researcher therefore engages with participants to explore their meanings or understanding of phenomena, and uses other ways of acquiring knowledge based on interpretations (293, 301).

There exists a third paradigm, pragmatism, which unlike the two above, holds to the view that at some stage during the research process, it will require an objective approach to acquire knowledge, while

other stages will need a more subjective approach (302). This means the pragmatic epistemology embraces both the positions of the positivist and interpretivist paradigms, and offers a flexible alternative which allows researchers to adopt the most practicable approach to address their research questions (302). In this sense, it bridges the gap between the positivist and interpretivist theories (303).

As seen above, the researcher's ontological position informs their epistemological perspective, which in turn shapes their methodological decision-making (304). If a researcher believes that the reality or knowledge they seek to obtain is objective, then they assume an observer role, applying methods like testing and measuring to understand it (294). If this knowledge is believed to be subjective, the researcher applies methods that require interpretation and engagement with their participants to understand it (299). Where this knowledge is believed to be partly objective and partly subjective, then a pragmatic epistemology would be suitable. These decisions shape researchers' choices around approaches to study design and interpretation.

3.2. RESEARCH METHODOLOGY AND UNDERLYING PHILOSOPHICAL ASSUMPTIONS

This PhD used a mixed methods research approach, which involves the collection and analysis of both quantitative and qualitative data, and the integration of both sets of results to draw inferences and make conclusions (305). Quantitative research methods were used during the systematic review phase of this research (Chapters 4 and 5), and involved both numerical and statistical analysis methods like meta-analyses (see Chapter 5 section 3.7). I aimed to obtain objective and quantifiable information from these reviews, so, in line with the positivist epistemology, quantitative methods provided an objective analytical means of integrating results from different studies of varying populations and sample sizes. They also offered a means of identifying patterns across the data, and exploring relationships between different variables (306-308).

The qualitative phase of this research (Chapters 7-9), was aimed at exploring perceptions, experiences and behaviours. These factors, I believe, are socially constructed and not purely objective – that is, they do not exist independently of the individual or their context (309, 310). Factors

like weight preferences, dietary behaviours and PA result from interactions and exchange of meanings between people; and how individuals construct their perceptions around these is shaped by external influences such as culture, migration and the environment (1, 66, 311, 312). Therefore, methods like observing and measuring would not be solely appropriate to obtain this knowledge. Rather, what suits is an interpretive approach that places emphasis on meaning-making and interpretations, based on individuals' experiences and perceptions of different phenomena (293).

There have been some challenges in developing a corresponding philosophical paradigm for mixed methods research (313). As is evident from the above two paragraphs, the knowledge this research seeks is partly objective and partly subjective, thereby requiring an approach that challenges the traditional distinction between objective and subjective research. Pragmatism has often been identified in the literature as the appropriate paradigm for conducting mixed methods research (314-318). I found pragmatism to be suitable for this thesis as it provides a middle position – both methodologically and philosophically, which supports the use of both quantitative and qualitative methods to answer research questions (316). With a pragmatic approach, research can assert that there is a single reality, and also that individuals have their separate interpretations of reality (303) (316). The above ontological and epistemological positions formed the basis for my research methodology and study design.

Using a mixed methods approach offers methodological flexibility, and combining the two research methods brings together the advantages of breadth and depth associated with the respective methods (302). This enables the researcher to collect rich and comprehensive data, and in so doing, the researcher is able to provide a more complete picture of the research problem in a way that can enhance theory development and practice (302, 316). Mixed methods research also has the advantage of being able to overcome the weaknesses inherent in adopting a monomethod approach (302, 303, 314). For example, while quantitative research allows for the simplification of research concepts, visualisation of patterns and trends in research data and eases the integration of complex data (e.g. through statistical testing), it is not possible to derive an in-depth understanding of

phenomena (e.g. the context or setting in which people behave) – something that qualitative research is best suited to do (302, 305). Meanwhile, qualitative research is founded on interpretations made by the researcher, and the complexity of analysing a wide range of interpretations, whereas quantitative research seeks to mitigate this through different data collection techniques and the application of statistical methods (302, 305). Using a mixed methods approach therefore offered me a suitable means of integrating my quantitative and qualitative findings, to provide a better understanding of the research problem I aim to address (305).

In the next three chapters, I will be presenting my systematic review methods and findings.

CHAPTER 4. SYSTEMATIC REVIEW BACKGROUND AND METHODS

4.1. CHAPTER OUTLINE

This chapter gives a rationale for, and background to, my systematic review followed by a description of the methods used during the process. It also discusses strengths and limitations of systematic reviews in general, and how these may influence the interpretation of findings. The findings from my systematic review are presented in chapters 5 and 6.

4.2. SYSTEMATIC REVIEW RATIONALE

Systematic reviews aim to critically appraise, synthesise and integrate existing evidence from primary studies in a particular area of interest (319). With the ever-growing volume of scientific literature and number of research articles being published annually, systematic reviews provide an efficient means of generating a comprehensive summary of available information to inform decision-making (320). Systematic reviews follow strict, explicit and reproducible protocols that aim to minimise bias and increase the reliability of findings (321). Due to their thorough, rigorous and transparent nature, findings from systematic reviews are considered the highest level of scientific evidence and often form the cornerstone of health care policy and guidelines (322-324). Systematic review evidence also helps support the identification of gaps in the literature, and to establish whether findings are consistent and generalisable, or whether they vary significantly by population, setting or particular subsets (321, 322, 325).

Prior to starting my systematic review, I conducted a scoping search of the existing literature on the weight status of African migrant women and children living in HICs. The general purpose of a scoping

search is to provide a broad overview of the breadth and depth of research that exists in a particular area, and they can also be undertaken as a precursor to a systematic review (326-328). The gaps identified during my scoping search formed the basis for my systematic review. These are discussed in the next section.

4.3. SYSTEMATIC REVIEW BACKGROUND

4.3.1. Ethnic inequalities in prevalence of overweight and obesity among women and children in HICs

The evidence on overweight and obesity among women of child-bearing age in HICs shows that women from Black or African ethnic backgrounds have a notably higher prevalence compared to women from other ethnic groups (119, 329-337). Ethnic disparities have also been reported for children, with Black children in countries like England (128, 338-343) and the USA (278, 332, 344, 345) being shown to have a higher risk of childhood overweight and obesity. Most of these studies, however, do not differentiate between migrant and non-migrant African populations, thereby not giving a clear representation of the risk for women who have migrated from an African country to live in a HIC, and their children. This also means that the evidence does not account for the influence of migration and related factors on their weight status.

There are several reasons why one might expect the risk of overweight or obesity to differ between migrant and non-migrant populations:

(i) Health inequalities

There is substantial evidence that migrants in HICs – both adults and children – face disproportionately higher risks of various health outcomes compared to the general population (219-222, 346). For African migrants, studies have shown increased vulnerability to non-communicable diseases (218, 347), poor mental health (217, 348), higher infant mortality (349-351) and adverse pregnancy outcomes (55-58). Health inequalities usually result from the uneven distribution of the social determinants of health, which are the conditions in which people are born, grow, live, work, and

age (352). Migrants are also particularly at risk of health disparities due to inequities in access to health care and quality of health services available to them (221, 353). Migration is a social determinant of health (68, 69, 215), and is associated with various factors that might shape obesity risk, such as cultural influences, lifestyle factors and behaviours both before and after migration (66, 69, 70, 215).

(ii) Socioeconomic deprivation

Migrants in HICs are often affected by social inequalities, resulting from factors like social exclusion, poverty, discrimination and limited rights accorded to them (68). Migrants also tend to occupy a less favourable social position as they are more likely to live in areas with cheap housing, are more likely to have poorer job security and endure more stressful working conditions, and also more likely to be economically deprived (72-76). These factors all have negative influences on health. Socioeconomic deprivation is shown to be associated with an increased risk of overweight and obesity in both adults and children (67, 354-357), so migrant women and their children may face higher risks of overweight and obesity than non-migrants.

(iii) Stress

When seeking to understand the complex interplay between migration and health, it is important to look at who migrates and why. Common drivers of migration include factors like financial hardship, job scarcity, political instability, poverty and human rights abuses (358, 359). In a study that looked at people's motivations for migrating out of Africa, the most commonly cited reasons were looking for work and escaping economic hardship (360). This shows that stressors from the country of origin are a cause of migration, and migrants may arrive at their destination countries with 'imported' stress. Stress can also be seen as a consequence of migration, as the migration process is itself known to be stressful (67). Upon arrival, many migrants continue to experience stress, often related to their reception into the host societies, which can range from acceptance and tolerance to hostility, aggression, marginalisation or racism (67, 361-363). Stress is a known contributor to excess weight

gain and promotes the uptake of behaviours that promote overweight and obesity, such as smoking and alcohol consumption (354, 364-366).

(iv) Social ties and adaptation

The ability to adapt into a new society requires the establishment of new social relationships. Migration is a prominent cause of loneliness due to reduced social relationships (367). Migrants may also face challenges with factors like getting employment, due to language barriers or lack of skills in the host country (368). Thus, the extent to which migrant populations adapt to living in HIC societies may differ from those of women who were born in HICs, due to differences in community networks and social support, and this can influence their physical and mental health, as well as their weight status (361, 369, 370).

4.3.2. Gaps identified

Given the factors presented above, it is important to consider migrant status when exploring trends in overweight and obesity among women and children in HICs. To my knowledge, there was previously no systematic appraisal of findings regarding weight status in African migrant women living in HICs and their children.

4.4. DETERMINANTS OF OVERWEIGHT AND OBESITY AMONG WOMEN OF CHILDBEARING AGE

Much of the literature on overweight and obesity has focused on behaviours that may contribute to excessive weight gain, and the mechanisms by which these can affect one's health. Two important behavioural factors that may contribute to excessive weight gain and also associated with overweight and obesity are dietary and PA behaviours (115, 371, 372).

4.4.1. Dietary behaviours

Maintaining a healthy diet is very important for women of child-bearing age, as they are in a nutritionally-vulnerable stage of the life cycle (373). A woman's nutritional status plays a central role

in determining her health and pregnancy outcomes, as well as the health of her children (13, 374). Women's dietary behaviours, including their knowledge of good nutrition and ability to purchase and prepare healthy food (or the lack of it) can also affect the health and nutritional status of the entire family, since they are usually responsible for producing and preparing food for the household in many societies.

Pregnant women are particularly susceptible to inadequate nutrition due to the high nutrient and energy demands of pregnancy, and the need for certain nutrients becomes heightened at this stage (373). The WHO has established guidelines and recommendations for intake of various nutrients in pregnancy (Table 3), to help improve health outcomes and prevent deaths in women and children worldwide (373). Pregnant women are also advised to take vitamin and mineral supplements daily in addition to a healthy diet, to help ensure that both the mother and baby get sufficient amounts of important nutrients like iron and folic acid (375). Certain supplements are also important in women before pregnancy; for example women of child-bearing age who are capable of getting pregnant are advised to take folic acid supplements in order to reduce the risk of neural tube defects (376).

Table 3: WHO recommended nutrient intakes in pregnancy

Macronutrients	
Carbohydrate (g)	175
Protein (g)	71
Total fat (g)	20-35
Cholesterol (g)	<300mg/day
Dietary fibre (g)	28
Micronutrients	
Vitamin A (mg)	800
Vitamin B1 (mg)	1.4
Vitamin B2	1.4
Vitamin B3	18.0
Vitamin B6	1.9
Vitamin B12 (mg)	2.6
Vitamin C (mg)	55
Vitamin D (mg)	5
Vitamin E (mg)	15
Folic acid (mg)	600
Iron (mg)	27

Macronutrients	
Calcium (g)	1.5–2
Selenium (mg)	30
Iodine (mg)	250
Zinc (mg)	10

Footnote: Data obtained from WHO (373)

4.4.2. Physical activity behaviours

PA has several benefits for women – it helps maintain a healthy weight, increases the chances of having a healthy pregnancy, and minimises the risk of poor pregnancy outcomes (377, 378). The WHO recommends that adults aged 18–64 years should do at least 150 minutes of moderate or 75 minutes of vigorous PA a week; or an equivalent combination of both (379). Their definition of PA includes any leisure time activities (e.g., walking, dancing, gardening, hiking, and swimming), transportation (e.g., walking or cycling), occupational (i.e., work), household chores, playing, games, sports, or any planned exercise. These guidelines are applicable for all adults irrespective of gender, ethnicity, or income level (379).

Pregnancy for most women is a uniquely challenging period, sometimes accompanied by both physical and emotional difficulties including weight gain, increased anxiety, stress, fatigue, or body image satisfaction (380, 381). PA during pregnancy has been shown to promote healthy weight gain (40, 382); and there is evidence that it provides substantial psychological benefits including reduced stress, anxiety, and depression, and increased body image satisfaction (383-385). It is important to understand the scope of barriers and equally enabling factors that may encourage women to become and stay active during their pregnancy.

4.4.3. Sociodemographic factors

Women's weight status and weight-related behaviours can be modified to variable extents by sociodemographic factors such as ethnicity, age, SES, education, income and parity (97, 101, 386-388). Factors like income, education and SES have shown opposing trends in women's risks of overweight and obesity in different parts of the world. In HICs, the risk increases with increasing

socioeconomic deprivation and lower educational and income levels (20, 389). Meanwhile, in LMICs, overweight and obesity are more common amongst women who are wealthy, have higher levels of education and are living in urban settlements (101, 390). However, some studies have observed that the urban-rural differential in LMICs seems to be shrinking, and an upward trend in overweight and obesity is being seen among women in rural settings in LMICs (391, 392).

4.4.4. Environmental factors:

Both food intake and energy expenditure are shaped by the environment in which people live. Some environmental influences on dietary behaviours include the proximity of large supermarkets and the concentration of fast food establishments or restaurants in a given area (393, 394). Large supermarkets may influence food purchasing behaviours and increase access to healthy foods, which are usually available in varieties and at reasonable prices (393). Living close to fast food establishments or restaurants on the other hand have been associated with an increase in out-of-home eating and consumption of processed foods, which are less healthy (393, 394). Environmental influences on PA include transportation systems, built environments and availability of recreation spaces for outdoor activity (394, 395). People are more likely to be active if they live close to parks or playgrounds, in neighbourhoods with sidewalks or bike paths, or within walking distance to work, school, or shops (396). On the other hand, negative influences on PA include neighbourhoods designed for driving, a lack of recreational facilities and low perceived neighbourhood safety (395-397).

The food industry is also a major contributor to the increase in overweight and obesity. Factors like food manufacturing, pricing, labelling, marketing and availability influence taste preferences and buying decisions (398, 399). Having a wide variety of relatively inexpensive, highly palatable and energy-dense foods as is the case in most HICs contributes to excess energy consumption (399). Portion sizes have increased over the years, and knowledge about healthy food products are largely influenced by the media (400). Exposure to TV commercials for fast foods, soft drinks, sweets, and chocolates have also increased, and have been shown to influence the food choices and dietary

habits of viewers, especially children and adolescents (400). In LMICs, globalization has resulted in the wide spread of fast-food chains and food retail industries, making energy-dense and processed foods more readily available and accessible to consumers (100). Moreover, food labelling standards are not always regulated, causing consumers to either be indifferent towards reading labels or find it challenging to understand the information provided (398, 401).

4.4.5. Determinants of overweight and obesity among migrant women of childbearing age

Several factors have been shown in the literature to influence the weight status of migrant women living in HICs (migrant women from other places as well as Africa). Table 4 summarises the evidence relating to these factors, which are broadly classed under two main themes: weight-related behaviours, and determinants of weight status and weight-related behaviours.

Table 4: Factors associated with overweight and obesity among migrant women in high-income countries

Factors	Summary evidence
	Weight-related behaviours
Dietary behaviours	Dietary behaviours of migrants usually become less healthy as they adopt the dietary patterns of the host country, resulting in increased consumption of processed foods that are energy dense and contain high levels of fat, sugar, and salt (70, 229, 234, 370, 402-405)
PA behaviours	Migrants are likely to become less active after migrating to HICs, and experience several barriers to PA (244, 363, 370, 406-409)
	Determinants of weight status and weight-related behaviours
Sociodemographic factors	Factors associated with an increased risk of overweight and obesity in migrant women include increasing age, lower levels of education, lower income, increased social disadvantage and being married (67, 405, 410-412)
Migration-related factors	The risk of overweight and obesity increases with increasing length of stay in HICs, younger age at migration and exposure to obesogenic environments in HICs (67, 70, 223, 238, 413-415)
Culture and religion	Culture and religion influence migrant women's weight perceptions and weight-related factors such as dietary preferences, cooking methods and behaviours towards PA (229, 404, 416-421)

Factors	Summary evidence
Other health-related factors	Factors like stress, smoking and alcohol consumption are associated with an increased risk of overweight and obesity in migrants (67, 422, 423).
Pregnancy-related factors	Factors like high pre-pregnancy BMI, high parity and high gestational weight gain are associated with an increased risk of overweight and obesity in migrant women (67, 335, 424).
Knowledge, beliefs and perceptions	Beliefs related to body image, food, PA and weight management influence migrant women's weight-related behaviours (418, 425-427)

4.4.6. Gaps identified

To my knowledge, there is no robust synthesis of available evidence on the dietary and PA behaviours of African migrant women of childbearing age living in HICs, and their determinants. Understanding behavioural changes as a result of migration may offer explanatory theories on factors influencing the weights of African migrant women, which can inform the development of sustainable interventions to improve health and pregnancy outcomes in this population.

4.5. SYSTEMATIC REVIEW AIMS

My systematic review had three aims, which were to synthesise the available literature on:

a) The prevalence of overweight and obesity among African migrant women living in HICs
b) The prevalence of overweight and obesity among children of African migrant women living in HICs
c) African migrant women's dietary and PA behaviours and their determinants

4.6. SYSTEMATIC REVIEW METHODS

Systematic reviews have a pre-defined structure, based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (428). They usually start with the development and publication of the study protocol detailing the plan of the review. This systematic review protocol was registered on PROSPERO (registration number CRD42017057562).

4.6.1. Database searching and study identification

One of the hallmarks of a well-conducted systematic review is a thorough and reproducible search of a range of sources to identify as many relevant studies as possible (429). Studies are identified through a search strategy, which assesses their eligibility for inclusion (430). The involvement of an experienced information scientist is recommended during the development of a search strategy, to aid in the definition of search terms and key words (430). An information scientist at Newcastle University (Linda Errington) supported the development of a comprehensive search strategy for this review. This was an iterative process, involving a definition, assessment and refinement of search terms.

Search terms and subject headings for this review were developed for MEDLINE (Appendix A), and translated across eight other electronic databases, which were: Embase, PsycINFO, Pubmed, the Cochrane Library, CINAHL, Scopus, ProQuest, Web of Science and the WHO African Index Medicus. It is advised that multiple databases be searched during systematic reviews to enhance the retrieval of relevant studies, as searches conducted on a single database are often found to have a low yield (431). The choice of database can also influence the success of a systematic review search (432, 433). The Cochrane handbook (434) identifies MEDLINE and Embase as 'key international general healthcare databases' and 'important literature sources for systematic reviews'. They also recommend searching subject-specific databases (such as CINAHL and PsycINFO), as well as regional databases. Cochrane suggests, in addition to database searching, that other search methods be employed to increase the yield of relevant studies that could have been missed during database searching (435). Additional studies were identified by hand-searching the reference lists of all included studies and performing citation searches on Google Scholar. Searches were restricted to studies published from 1990 onwards, as this time period represents the start of a significant peak period of migration from African countries to HICs (436). Database searches were completed in June 2018 and updated in August 2019. Authors of included studies were contacted if additional data were required for the analyses, and this was completed in November 2019.

4.6.2. Inclusion criteria

The search strategy was developed to capture primary research studies, both quantitative and qualitative which were conducted in HICs and reporting on the following:

- Population: Eligible study populations were women who have migrated from an African country to live in a HIC (African migrant women), including both pregnant women and non- pregnant women of child-bearing age (16 – 45 years). Eligible populations for child weight outcomes were children of African migrant women living in HICs.
- Outcomes:
    - Eligible maternal outcomes were: (a) mean BMI (pre-pregnancy, early pregnancy or BMI in non-pregnant women of child-bearing age), (b) prevalence or risk of overweight or obesity, (c) dietary behaviours, (d) PA behaviours, and (e) determinants of outcomes a-d.
    - Child outcomes were: (a) birthweight, (b) child overweight and/or obesity.

4.6.3. Exclusion criteria

Studies including women described as 'Black' or 'foreign born' without specifying their regions or countries of origin were excluded, the reason being that these studies may have either included women who were not of African origin, or combined migrant and non-migrant populations. Similarly, studies including 'Black' children without specifying whether they had migrated from an African country or stating that their mothers had migrated from an African country, were excluded. This review also excluded studies on African women or children living in HICs as refugees or asylum seekers, because their living circumstances are considerably different from those of other migrants, given that they have been forcibly displaced.

4.6.4. Deduplication

Searching multiple databases often results in the retrieval of numerous duplicate citations, which could result from conference abstracts and full-text articles reporting the same information, studies

being included in multiple databases, or existing studies being reproduced or reformatted (437, 438). Besides increasing the workload for reviewers, including multiple reports of the same study can overemphasise the importance of study findings (439). Removing these duplicates, a process known as deduplication, is therefore necessary to ensure the inclusion of a valid, non-repetitive and reliable pool of studies in the systematic review (437). All studies resulting from database searches were imported into EndNote Version X8, where deduplication was performed.

4.6.5. Study selection and screening

Systematic reviews follow stringent procedures during study selection and screening, in order to enhance the reliability of results. An important step is for the research team to have an agreement on the study's inclusion and exclusion criteria. To have this consensus, 10 percent of all titles and abstracts identified were independently screened by me and two of my supervisors (Judith Rankin and Nicola Heslehurst), after which we all reached an agreement on study eligibility and inclusion. I then proceeded to screen the titles and abstracts for the remaining 90% of identified papers, and these were double screened by two other PhD students (Adefisayo Odeniyi and Zainab Akhter). The full texts of all studies identified as potentially eligible from title and abstract screening were retrieved and screened by myself and also duplicate screened by the same two PhD students.

The double screening approach is an internationally recognised standard recommended as a means of increasing the accuracy and reliability of screening records (440, 441). Though time-consuming and resource-intensive, double screening helps minimise systematic errors by ensuring that inclusion criteria are applied consistently, and that random mistakes are identified and corrected (442). Studies have also shown that eligible studies are more likely to be missed when screened by one reviewer, as compared to two independent reviewers (441, 443). Disagreements between reviewers during screening are usually resolved through discussion. There were no inconsistencies for this review.

4.6.6. Data extraction

The data extraction process involves the transcription of information from included studies onto a standard form developed to capture all relevant data for analysis. This stage is critical to the findings of a systematic review and conclusions made, as subsequent analyses and interpretations rely on the data extracted. As is the case with screening, data extraction performed by a single individual is prone to errors (444, 445). Hence, current guidelines recommend that data extraction be performed independently by two reviewers (434, 444).

A data extraction form was developed in Microsoft Excel (Appendix B) and piloted by me and the two supervisors. This collected the following information from each study: the study title, the journal title, the publication year, the study type, the host country, the country of origin of African women, participants' ages, pregnancy status, gestational ages (for pregnant women) and outcomes reported. Data extractions for all included studies were then carried out in duplicate by me and the other two PhD students, and discrepancies were resolved through discussion.

4.6.7. Quality assessment

One goal of systematic reviews is to minimise bias (446). Bias can be understood as a systematic error which may lead to the production of outcomes or conclusions without proper consideration of the possibility misleading information (447). Several factors can introduce bias in a systematic review, including flaws in the design, conduct or reporting of primary studies, as well as errors during the systematic review process (442, 447, 448). Conducting a critical assessment of included studies is therefore an important component of systematic reviews (447).

Two quality assessment tools were used in this review. Quantitative studies were assessed using the Quality Assessment Tool for Observational Cohort and Cross-sectional Studies (449). This tool assessed studies on 14 criteria (Appendix C) and quality ratings were determined based on scores. Studies were either deemed to be of good quality (at least eight of the 14 criteria met) fair quality (at least five but less than eight of the 14 criteria met) or poor quality (less than five criteria met).

Qualitative studies were assessed using the Critical Appraisal Skills Programme (CASP) checklist (450), which assessed studies on 10 criteria (Appendix C). Good quality studies met at least six of these criteria, fair quality studies met at least four but less than six criteria, while poor quality studies met less than four of the criteria. Interpretations for quality ratings were as follows: good: studies have minimal risk of bias; fair: studies were susceptible to some bias but not enough to invalidate their results; and poor: studies had major limitations and significant risk of bias. All quality assessments were carried out in duplicate by me and the other two PhD students, and there were no inconsistencies.

4.6.8. Data analysis

The studies included in this review were analysed differently, depending on the outcomes they reported on. There were three groups of data: women's weight outcomes, child weight outcomes and women's behaviours (dietary and PA behaviours and their determinants). The data analysis methods used for each of the outcomes are described below.

4.6.8.1. Meta-analysis

A meta-analysis provides an objective analytical method of integrating results from different studies of varying sample sizes and populations (306). It is useful for identifying patterns across studies, sources of disagreement among results, and other interesting relationships that may emerge from multiple studies (307, 308). Meta-analyses are valuable for establishing whether scientific findings are consistent, and enable the identification of moderating or mediating variables that may explain the reasons for these discrepancies (451, 452).

A meta-analysis was performed if the following conditions were met:

- At least two studies reported on the same outcome (453).

- Studies provided all data required for the meta-analysis. Where all data could not be obtained from the publication, authors were contacted to provide additional data.
- Studies included a non-African comparison group. Comparison groups were women who were originally from the host country (e.g. a study conducted in England compared weight outcomes in African migrant women with those of English women. For children, these compared weight outcomes in children of African migrant women with those of children of English women). Studies with no comparison groups were analysed descriptively.

(i) Outcomes included in the meta-analysis

(a) Maternal weight outcomes: Maternal weight outcomes analysed using a meta-analysis were mean BMI, overweight (BMI 25 – 29.9 Kg/m^2), obesity (BMI≥30 Kg/m^2) and combined overweight and obesity (BMI≥25 Kg/m^2) – henceforth denoted as overweight/obesity.

(b) Child weight outcomes: Child weight outcomes analysed using meta-analyses were childhood overweight, child obesity, child overweight/obesity, mean birthweight, macrosomia (birthweight>4000g) and low birthweight (LBW) (<2500g). All studies included in the reviews on child weight status assessed child BMI using the WHO child BMI centiles.

(ii) Meta-analysis methods

(a) Odds Ratios

Odds ratios (ORs) and 95% confidence intervals (CIs) for the above outcomes were either obtained from the studies or calculated where frequency data were provided, and pooled estimates were obtained using the DerSimonian and Laird random effects model (454). Unlike a fixed effects model which assumes equal effect sizes in all studies, the random-effects analysis assumes that the true effect size varies from one study to the other, representing a random sample of effect sizes (455). Thus, a random-effects model helps to account for between-study differences. For all analyses, a two-sided p-value of <0.05 was considered statistically significant.

(b) Weighted mean difference (WMD)

A weighted mean difference (WMD) and 95% CI was used to compare mean BMI between African migrant and non-African women, and also to compare mean birth weights between African and non-African children.

(c) T-test

In addition to comparing African migrant women's mean BMI with that of non-African women from the host HICs, I also made comparisons between the mean BMI of African migrant women living in HICs and that of African women living in Africa. The data on African migrant women in HICs came from the studies included in the systematic review, while the data on women in Africa came from the WHO global health observatory (latest available data set from 2016) (92). An unpaired student's t-test was performed to compare the mean BMI between both groups of women.

(d) Assessment of heterogeneity

Heterogeneity across studies was tested using the Cochrane *Q* test and quantified with the I^2 statistic – an I^2 value below 25% was defined as low heterogeneity, between 25 and 75% was considered medium heterogeneity and above 75% was considered significant heterogeneity. Significant heterogeneity signifies variability in the study data and questions the generalisability of the study results (456). In this case, it is important to investigate sources of heterogeneity, by identifying factors that may be significant determinants of sub-population differences (456). Possible sources of heterogeneity in this research were investigated using sub-group analyses and meta-regression for meta-analyses where significant heterogeneity was present.

- **Sources of heterogeneity for maternal weight meta-analyses**

Potential sources of heterogeneity were defined *a-priori*. These were variables identified in the literature as having a significant influence on migrant women's weight status or risk of overweight and obesity (see Table 4), as well as factors that could influence findings from individual studies (sample size, study design, study quality, host country and BMI assessment method).

Initial results for all outcomes combined data for pregnant and non-pregnant women. The decision was taken to combine these groups because the pregnant women were all in their early weeks of pregnancy, during which very minimal weight is gained. Results were subsequently analysed separately by pregnancy status, to determine if there were different patterns between pregnant and non-pregnant women. Studies were further sub-grouped according to African women's region of origin. There is evidence that the trends in overweight and obesity in Africa are different in North Africa compared to other African regions (104, 457). Thus, North African women were grouped separately from women originating from East, West and Central Africa (grouped together as SSA). Studies were also sub-grouped according to the method used to assess women's BMI. Compared to measured BMI, BMI derived from self-reported height and weight tends to result in an underestimation of overweight and obesity (458, 459). The influence of sample size, study quality and host country were investigated using meta-regression analysis – a technique used to examine the impact of explanatory variables (study characteristics that might influence the study outcome) on study effect size (434). The regression coefficient obtained from a meta-regression analysis describes how the outcome changes with a unit increase in the explanatory variable (434). It was not possible to investigate the effects of maternal age and duration of residence in HICs due to insufficient data reported in the included studies.

- **Sources of heterogeneity for child weight meta-analyses**

Potential sources of heterogeneity for child weight defined *a-priori* were: child age, African mother's region of origin, mother's duration of residence in HIC, maternal BMI, maternal age, child sex, sample size, study quality and host country. However, it was only possible to explore child age, African mother's region of origin, sample size, study quality and host country, as studies did not provide sufficient data for the other variables.

(e) Sensitivity analysis and publication bias

A sensitivity analysis was performed by excluding studies one at a time, to explore their individual effects on the pooled effect size. Publication bias was assessed using funnel plots, which are simple graphical plots of the effect estimates of each study against their sample sizes (460). A funnel plot is a simple graph that plots the estimates of the treatment effects of each study against the measure of its precision. An asymmetric funnel plot indicates that there is publication bias (460). Egger's test was carried out to test for funnel plot asymmetry, and a significant p-value ($p<0.05$) was indicative of small-study effects, which shows publication bias. Small-study effects means that small primary studies with positive results were more likely to be published (460). All analyses were performed using Stata/SE 16.0.

4.6.8.2. Framework synthesis

African migrant women's weight-related behaviours and their determinants were analysed narratively using framework synthesis. This method offers a structured approach to organise and analyse data (461) and is particularly useful to integrate qualitative and quantitative evidence in meta-synthesis (462). It involves the utilisation of an *a priori* framework to code data, which can then be modified to reflect the evidence reported in the included studies (463). The *a priori* framework was informed by background literature and consisted of the factors shown in Table 4 (section 4.4.4) which have been shown to influence weight status and weight-related behaviours of migrant women in HICs. The framework was adapted throughout the process of data synthesis to incorporate and reflect themes that emerged from the data. This framework provided a matrix onto which relevant data from the included studies were coded. Relevant data included narratives from results sections, figures, data tables, and supplementary materials.

The framework synthesis process involved me and one of my supervisors (Nicola Heslehurst) and the following stages: familiarisation with the data, identification of a thematic framework, indexing, charting the data into the framework matrix, and mapping and interpretation (461). The familiarisation stage was an iterative process where all included studies were read several times, while marking

portions of data with relevant information. Codes were then applied to fragments of text with information that was relevant to the review. Coding also involved making notes on questions to consider during the analysis process. The codes were then assessed for similarities and differences, and clustered together around similar concepts. Included studies were checked again to ensure that no new codes could be generated from the data. Any new themes that emerged were assessed to establish whether they were in fact new, or subgroups related to the existing *a priori* themes. In the final stage, the themes were used to explore patterns and relationships within the data.

4.7. PRESENTATION OF FINDINGS

Findings from this review are written up as three distinct systematic reviews. Results on the prevalence of overweight and obesity in African migrant women and their children are presented in Chapter 5, while chapter 6 presents my findings on African migrant women's dietary and PA behaviours, and their determinants. Each of these chapters includes some narrative around their findings and a summary of main results presented at the end. The general discussion of results from each systematic review are presented in the overall discussion in chapter 10.

4.8. STRENGTHS AND LIMITATIONS OF SYSTEMATIC REVIEWS

As described in section 4.2., systematic reviews are traditionally recognised as producing high quality evidence due to their thorough, rigorous and transparent nature. However, they also have potential limitations that should be recognised. One of their major setbacks is that the evidence provided is only as reliable as the methods used in the individual primary studies (464). Thus, conducting a systematic review and/or meta-analysis does not overcome errors or problems that were inherent in the design or conduct of the primary studies (464, 465). Secondly, as the review process identifies studies that are diverse in design, methodological quality and study populations, pooling studies of poor quality with more rigorously conducted ones may produce misleading estimates (466). Systematic reviews also do not correct biases resulting from selective publication (where studies reporting positive or larger effects are more likely to be identified as compared to studies reporting

negative or smaller effects) or selection bias where studies only aim to identify studies in a particular language as was the case in this thesis (464). It is therefore important to identify and acknowledge the limitations of individual systematic reviews, outlining how they may influence the interpretation of findings. It is also important to note that systematic reviews are only capable of synthesizing findings on areas that primary research authors have deemed worthy of investigation or publication, and are also limited by publication bias from what journals have deemed important to publish. This may make it challenging to fill important knowledge gaps. The limitations of my systematic reviews are discussed in chapter 10.

CHAPTER 5: PREVALENCE OF OVERWEIGHT AND OBESITY IN AFRICAN MIGRANT WOMEN AND CHILDREN LIVING IN HIGH INCOME COUNTRIES

5.1. CHAPTER INTRODUCTION

This chapter presents my findings on the weight status of African migrant women and children living in HICs. The chapter is divided into two sections: section I describes how the weight status of African migrant women compares with that of non-African women from the host HICs and also how the weight status of African migrant women compares with that of women living in Africa. In section II, I describe how the weight status of children born to African migrant women compares with that of children born to women from the host HICs. Each section begins with a summary of all studies identified after the search, followed by a description of included studies, a presentation of results with some discussion of main findings, and a chapter summary.

SECTION I: RESULTS ON MATERNAL WEIGHT

5.2. DESCRIPTION OF INCLUDED STUDIES

A total of 4,343 citations were retrieved after the search. After duplicates were excluded and titles, abstracts and full-texts were screened against the inclusion criteria, 30 studies were eligible for inclusion (Figure 5). The characteristics of these studies are shown in Table 5. A majority of the studies (n=25) were conducted in European countries which were: Belgium (n=1) (467), France (n=2) (468, 469), Ireland (n=1) (470), Italy (n=5) (471-475), Norway (n=2) (476, 477), Spain (n=1) (478), Sweden (n=3) (479-481), the Netherlands (n=9) (419, 482-489) and the UK (n=1) (490). Two studies were conducted in Australia (491, 492), one in Israel (493) and two in the USA (494, 495).

Seven studies included women from North Africa (419, 467, 471, 472, 485, 486, 489), 13 included women from SSA (468-470, 474, 476-478, 480, 481, 488, 491-493), six included women from both African regions (475, 479, 482-484, 487) and four studies did not specify the women's African region of origin (473, 490, 494, 495). In studies that specified participants' countries of origin, African women had migrated from 18 countries – four North African countries (Morocco, Algeria, Tunisia and Libya) and 14 countries in SSA (Ghana, Nigeria, Somalia, Tanzania, Burundi, Eritrea, Ethiopia, Benin, Cape Verde, Gambia, Ivory Coast, Liberia, Mali and Congo).

Sample sizes for African women ranged from 19 to 11,268, giving a total of 18,188 women. For non-African women, sample sizes ranged from 58 to 421,754, summing up to 484,109 women. Fourteen studies reported data on maternal age: there were five studies where African women were younger than non-African women (468, 479, 482, 496, 497); four with African women being older than non-African women (485, 487, 489, 495) and two studies reporting women being of similar age groups (467, 471). Nine studies included pregnant women (467, 468, 470, 481, 482, 484, 487, 490, 495), with gestational ages ranging between 8-16 weeks at the time of BMI measurement.

Assessment of study quality found 20 good quality studies and 10 of fair quality (Table 5 and Appendix C). The most frequently met quality criteria were: clearly stated research objectives, clear definition of study population and recruitment criteria, high participation rates and outcomes based on measured BMI. Studies of fair quality either did not clearly define the criteria used for participant recruitment or included small, convenience samples with no justifications for their sample sizes.

Figure 5: PRISMA flow chart showing selection of studies for inclusion in systematic review on maternal weight

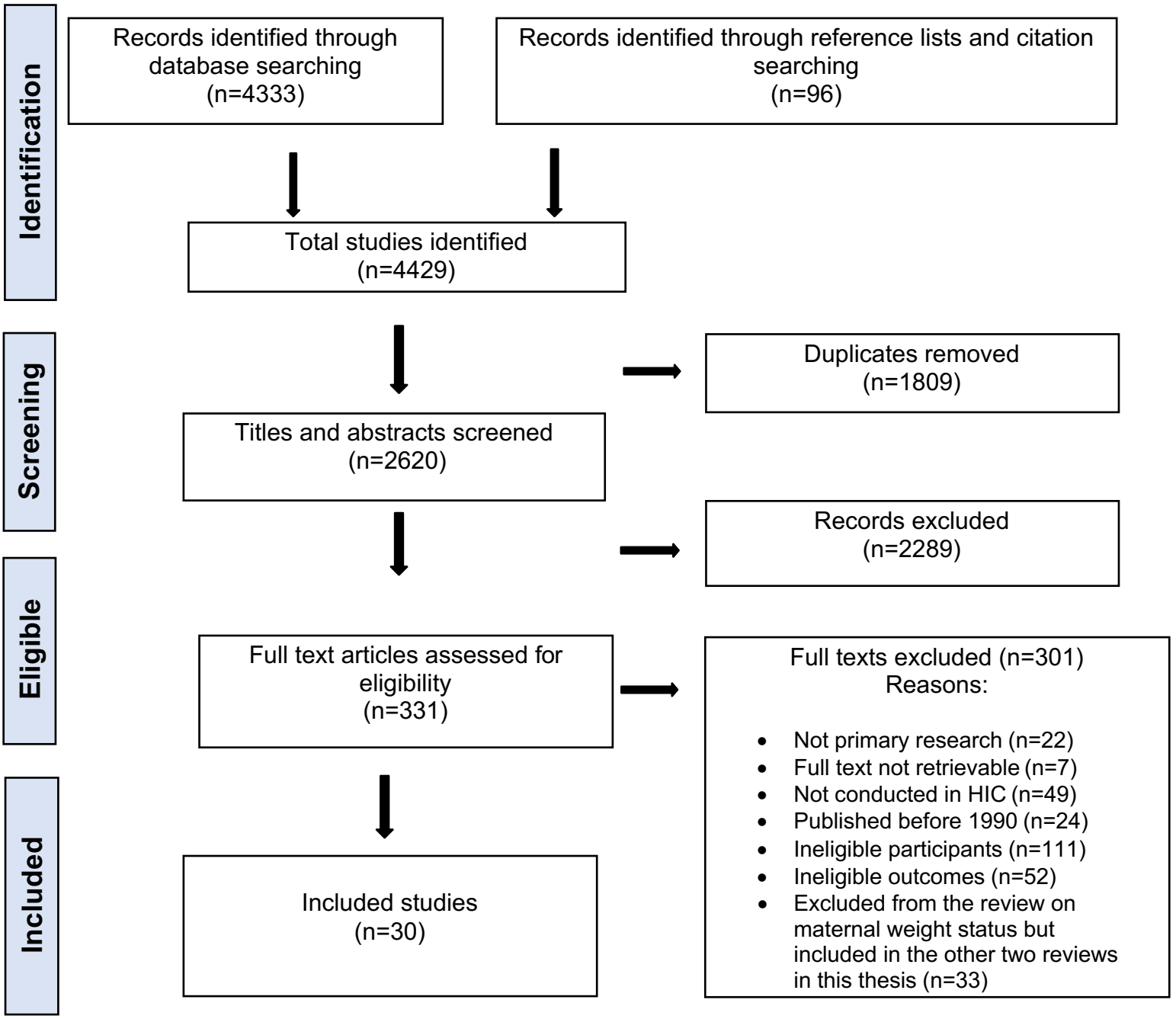


Table 5: Description of studies included in the systematic review on maternal weight

Author, year & reference number	Study design	Host country	Study population			Participant ages Mean (SD) or % or age range		Gestational age when BMI measured	BMI assessment method	Quality rating
			African region & sample size	African countries of origin	Comparison group, N	African migrant	Comparison group			
Studies including pregnant women										
Bahadoer *et al*. 2015 (482)	Prospective cohort	Netherlands	NA & SSA, n=924	Morocco, Cape-Verde	Dutch; n=3,992	28.1 (5.3)	31.2 (4.5)	14 weeks	Measured	Good
Bjermo *et al*. 2015 (481)	Retrospective cohort	Sweden	SSA, n=11,268	Not specified	Swedish; n=421,754	NR	NR	8-12 weeks	Measured	Good
Casali *et al*. 2015* (475)	Cross-sectional	Italy	NA, SSA, n=97	Not specified	None	31.8 (7.3)	n/a	<8 weeks	Measured	Fair
Djelantik *et al*. 2011 (484)	Prospective cohort	Netherlands	NA & SSA, n=1080	Morocco, SSA countries not specified	Dutch; n=4,900	NR	NR	12-14 weeks	Self-reported	Good
Elo *et al*. 2010 (495)	Prospective cohort	USA	Region not specified, n=106	NR	American; n=2,816	28.8 (5.9)	24.2 (5.8)	<21 weeks	Self-reported	Good
Rovillé-Sausse *et al*. 1998 (468)	Cross-sectional	France	SSA, n=129	Senegal, Mali, Niger	French; n=320	27.7 (SD NR)	28.5 (SD NR)	Not specified	Measured	Fair
Vahratian *et al*. 2004 (467)	Retrospective cohort	Belgium	NA, n=354	Algeria, Morocco and Tunisia	Belgian; n=808	<35: 84.7	<35: 90.3	At 1st antenatal visit (age not specified)	Self-reported	Good

Author, year & reference number	Study design	Host country	Study population			Participant ages Mean (SD) or % or age range		Gestational age when BMI measured	BMI assessment method	Quality rating
			African region & sample size	African countries of origin	Comparison group, N	African migrant	Comparison group			
Van Poppel *et al.* 2012 (487)	Retrospective cohort	Netherlands	NA & SSA, n=224	Morocco, Ghana	Dutch; n=2,601	31.5 (4.7)	32.3 (3.0)	16 weeks	Self-reported	Good
Studies including non-pregnant women										
Agyemang *et al.* 2009 (488)	Cross-sectional	Netherlands	SSA, n=82	Ghana	Ghanaian women in Ghana; n=736	37.9 (8.9)	35.8 (14)	n/a	Measured	Good
Ahmed *et al.* 2018 (476)	Cross-sectional	Norway	SSA, n=111	Somalia	Somalian women in Somalia; n=955	37.7 (10.1)	39.1 (14.1)	n/a	Measured	Good
Aronsen *et al.* 2015 (480)	Cross-sectional	Sweden	SSA, n=62	Somalia	None	34.8 (10.7)	n/a	n/a	Measured	Good
Cohen *et al.* 2017 (469)	Cross-sectional	France	SSA, n=28	Cameroon	Cameroonian women in Cameroon; n=310	18-30	18-30	n/a	Measured	Good
De Hoog *et al.* 2012 (483)	Retrospective cohort	Netherlands	NA & SSA, n=343	Morocco, Ghana	Dutch; n=1,744	34.5 (5.6)	38.3 (3.8)	n/a	Self-reported	Good
Dijkshoorn *et al.* 2011 (485)	Cross-sectional	Netherlands	NA, n=160	Morocco	Dutch; n=258	44.2 (13.0)	43.5 (13.9)	n/a	Measured	Good
Dijkshoorn *et al.* 2014 (498)	Cross-sectional	Netherlands	NA, n=122	Morocco	Dutch; n=2126	26.7 (5.3)	25.4 (5.4)	n/a	Measured	Good

Author, year & reference number	Study design	Host country	Study population			Participant ages Mean (SD) or % or age range		Gestational age when BMI measured	BMI assessment method	Quality rating
			African region & sample size	African countries of origin	Comparison group, N	African migrant	Comparison group			
Dominguez *et al.* 2008 (474)	Cross-sectional	Italy	SSA, n=23	Ivory Coast, Ghana, Nigeria, Mali, Benin	None	29.9 (8.3)	n/a	n/a	Measured	Fair
Gele *et al.* 2013 (477)	Cross-sectional	Norway	SSA, n=115	Somalia	None	25+	n/a	n/a	Measured	Good
Gil *et al.* 2005 (478)	Cross-sectional	Spain	SSA, n=130	Equatorial Guinea	None	18-30	n/a	n/a	Measured	Fair
Gualdi-Russo *et al.* 2009 (472)	Cross-sectional	Italy	NA, n=22	Morocco	Italian; n=58	36.3 (9.1)	36.9 (9.1)	n/a	Measured	Good
Gualdi-Russo *et al.* 2016 (471)	Cross-sectional	Italy	NA, n=105	Morocco, Tunisia	Italian; n=100 North African women in Morocco & Tunisia; n=228	34.8 (10.8)	33.1 (12.0)	n/a	Measured	Good
Kelly *et al.* 2009 (490)	Retrospective cohort	UK	Region not specified, n=327	Not specified	British, n=14,068	20-40	20-40	n/a	NR	Fair
Lindsay *et al*. 2014 (470)	Cross-sectional	Ireland	SSA, n=52	Nigeria	None	32 (6.3)	N/A	n/a	Measured	Fair
Mehta *et al.* 2015 (499)	Cross-sectional	USA	Region not specified, n=1435	Not specified	American; n=33,771	NR	NR	n/a	Self-reported	Fair

Author, year & reference number	Study design	Host country	Study population			Participant ages Mean (SD) or % or age range		Gestational age when BMI measured	BMI assessment method	Quality rating
			African region & sample size	African countries of origin	Comparison group, N	African migrant	Comparison group			
Menigoz *et al.* 2009 (491)	Retrospective cohort	Australia	SSA, n=68	Not specified	Australian; n=5,287	NR	NR	n/a	Self-reported	Good
Nicolaou *et al.* 2008 (419)	Cross-sectional	Netherlands	NA, n=104	Morocco	None	23.4 (4.2)	n/a	n/a	Measured	Fair
Regev *et al.* 2012 (493)	Cross-sectional	Israel	SSA, n=53	Ethiopia	None	32 (6)	n/a	n/a	Measured	Good
Saleh *et al.* 2002 (492)	Cross-sectional	Australia	SSA, n=35	Ghana	None	34.8 (7.9)	n/a	n/a	Measured	Fair
Somaraki *et al.* 2018 (500)	Retrospective cohort	Sweden	NA & SSA, n=19	Libya, Morocco Burundi, Congo, Eritrea, Ethiopia, Gambia, Ghana, Ivory Coast, Liberia, Somalia, Tanzania;	Swedish; n=941	33.4 (SD NR)	37.1 (SD NR)	n/a	Self-reported	Good
Toselli *et al.* 2015 (473)	Cross-sectional	Italy	Region not specified, n=72	Not specified	Italian; n=2,337	NR	NR	n/a	Self-reported	Good

Author, year & reference number	Study design	Host country	Study population			Participant ages Mean (SD) or % or age range		Gestational age when BMI measured	BMI assessment method	Quality rating
			African region & sample size	African countries of origin	Comparison group, N	African migrant	Comparison group			
Ujcic-Voortman *et al.* 2011 (489)	Cross-sectional	Netherlands	NA, n=161	Morocco	Dutch; n=296	43.8 (14.1)	42.2 (15.8)	n/a	Measured	Fair

Footnote: *study included both pregnant and non-pregnant women; NA – North Africa; SSA – sub-Saharan Africa; NR – not reported; n/a – not applicable

5.3. RESULTS ON MATERNAL WEIGHT

5.3.1. Meta-analysis of mean BMI

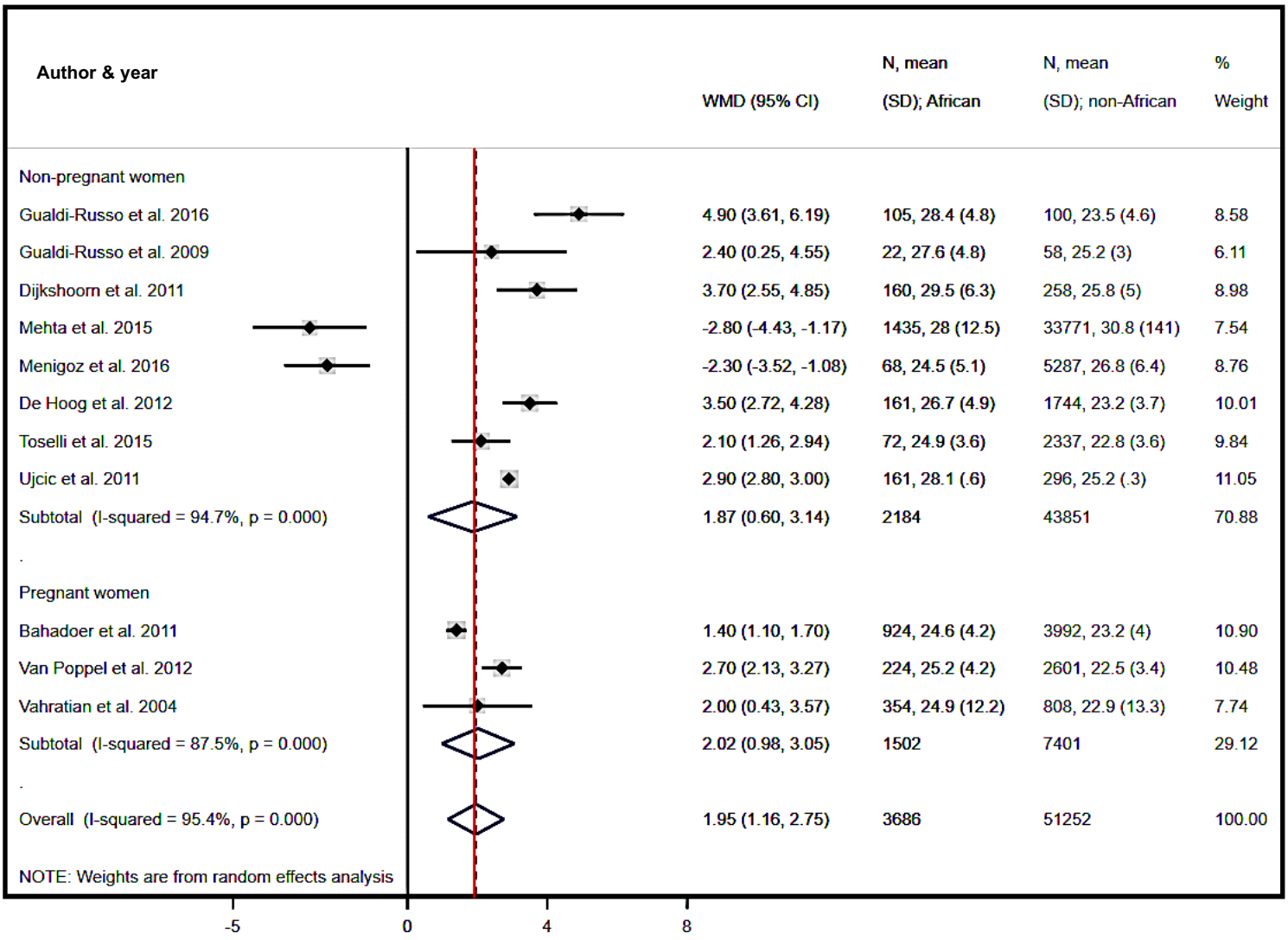
Twenty-three studies provided mean BMI data (418, 467-474, 476-478, 482, 483, 485, 487-489, 491-494) and 11 (467, 471-473, 482, 483, 485, 487, 489, 491, 494) were included in the meta-analysis comparing mean BMI in African migrant women and non-African women. Three studies reported on pregnant women (gestational ages 12-20 weeks) (467, 482, 487) and eight reported on non-pregnant women (471-473, 483, 485, 489, 491, 494). Twelve studies were excluded from the meta-analysis because they either did not include a non-African comparison group (418, 469, 470, 474, 476-478, 488, 492, 493) or did not provide sufficient data for the meta-analysis (468, 490). Results for these studies are reported narratively.

As described in Chapter 4, overall analyses were carried out for all maternal outcomes combining data on both pregnant and non-pregnant women, before sub-grouping by pregnancy status to account for any differences. Data for pregnant and non-pregnant women were then combined for subsequent sub-group analyses. Initially, these subsequent analyses were also done separately by pregnancy status, but pregnancy status did not appear to play a role on the outcomes for either group of women. This is probably because the pregnant women were in their early stages of pregnancy, and, as mentioned in Chapter 5 and supported by the literature, weight gained in early pregnancy is minimal. So, combining pregnant and non-pregnant women in the analyses would not make much difference to the study results. Keeping the data on pregnant and non-pregnant women together in further sub-group analyses also enabled me to explore trends in women's BMI by other factors – for example, sub-grouping by pregnancy status before further grouping by African region of origin was not always possible to do due to small study numbers, whereas keeping the data together allowed me to this.

5.3.1.1. Mean BMI of African migrant women compared to non-African women from the host HICs

African migrant women had significantly higher mean BMI compared to non-African women in the overall analyses (WMD 1.95 Kg/m^2, 95%CI 1.16 to 2.75), and also when sub-grouped by pregnancy status (WMD pregnant women = 2.02 Kg/m^2, 95%CI 0.98 to 3.05; WMD non-pregnant = 1.87 Kg/m^2, 95%CI 0.60 to 3.14) (Figure 6). There was significant heterogeneity across studies in the overall analysis (I^2=95.4%, p<0.01) (Figure 6), and this remained significant after sub-grouping by pregnancy status, albeit slightly reduced for pregnant women (I^2=87.5%, p<0.01) (Figure 6).

Figure 6: Mean BMI of African migrant women compared to non-African women – overall analysis sub-grouped by pregnancy status



Footnote: WMD – weighted mean difference; N – sample size, mean – mean BMI, SD – standard deviation

Further sub-group analysis by region of origin showed significantly higher mean BMI for North African women compared to non-African women (WMD 2.50 Kg/m^2, 95%CI 1.38 to 3.62) (Figure 7); and also for two studies that included women from both African regions (WMD 2.03 Kg/m^2, 95%CI 0.75 to 3.30). Heterogeneity remained significantly high for both sub-groups (I^2>90%, p<0.01). There was insufficient data to form a sub-group for women from SSA, as only one study included women from this region (showing a non-significant result WMD -2.30, 95%CI -3.52 to -1.08). One other study did not specify the women's region of origin, and mean BMI in this study was significantly higher for African migrant women compared to non-African women (WMD 2.10 95% CI 1.26 to 2.94) (Figure 7).

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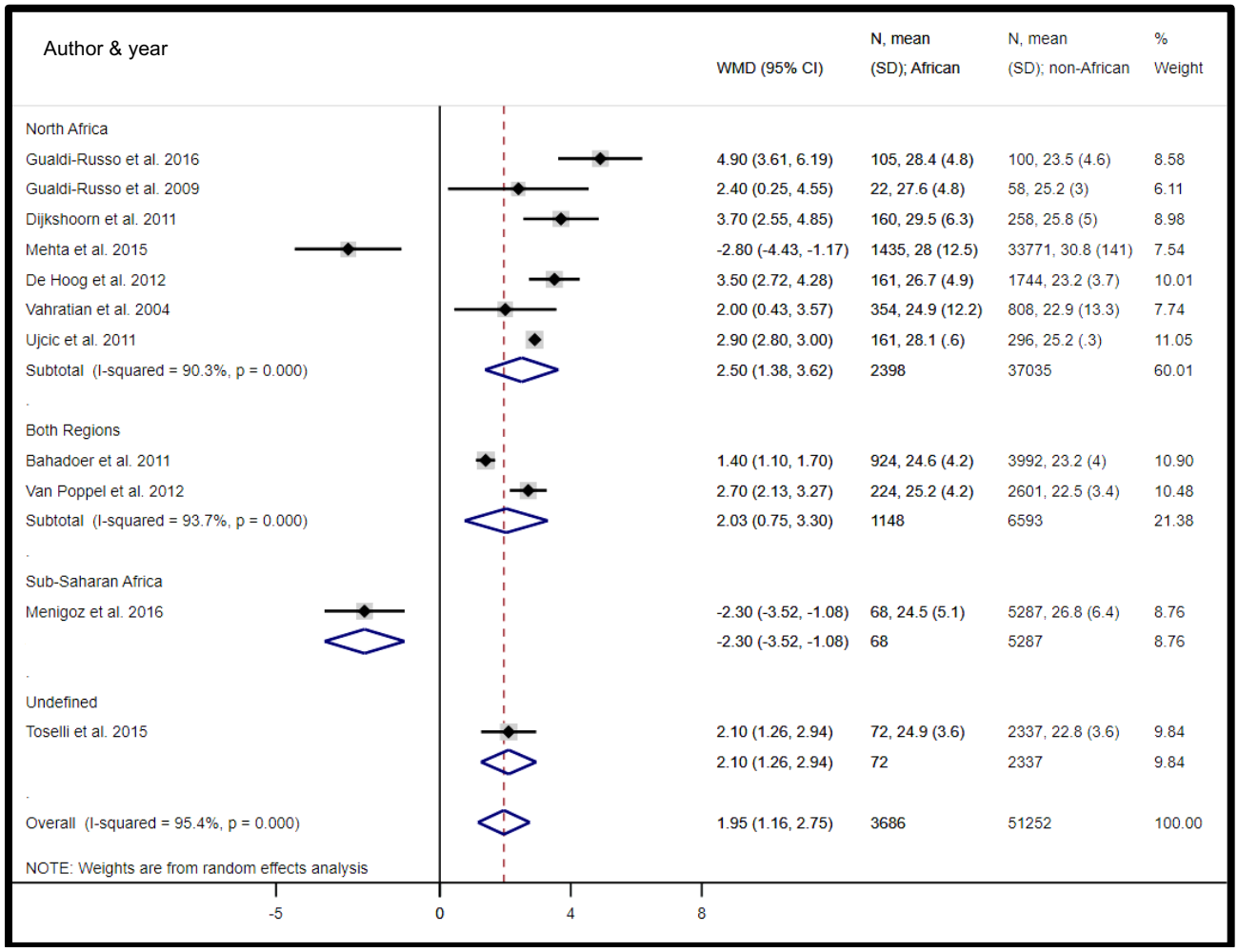
Figure 7: Mean BMI of African migrant women compared to non-African women sub-grouped by African region of origin



Footnote: WMD – weighted mean difference; N – sample size, mean – mean BMI, SD – standard deviation; undefined – studies did not specify the African women's region of origin; both regions – studies included women from both North Africa and SSA

Sub-grouping studies on North African women by BMI assessment method reduced heterogeneity for studies reporting measured BMI, though this was still significant (I^2=78.8%, p<0.05) (Appendix D). The results showed higher mean BMI for African women compared to non-African women (WMD 3.45 Kg/m^2, 95%CI 2.02 to 4.88). Meanwhile, studies with self-reported BMI found no significant difference between African and non-African women (WMD 1.67 Kg/m^2, 95%CI -0.84 to 4.17), and heterogeneity was not reduced (I^2=94.1%, p<0.01) (Appendix D).

The above results show evidence of higher BMI among African migrant women compared to women from HICs. It also showed evidence of high BMI for women from North Africa, while highlighting a data gap for women from SSA since most of the studies in the meta-analysis included women from North Africa. As such, it was not possible to compare mean BMI between women from SSA and women from HICs. Data from African countries have shown different patterns in weight status between women from North Africa and women from SSA, with North African women usually having higher BMIs (20, 457). It would be useful to know whether women's BMI after migration follow the same patterns as observed in Africa (that is, North African women having higher BMI than women from SSA), and also how these compare with those of non-African women.

It can be seen from Figures 6 and 7 that the results from two studies (491, 494) were quite different from the others – while most of the individual studies showed that African migrant women had higher mean BMI compared to non-African women, these two studies showed the contrary. One thing in common with both studies is that they were conducted in non-European countries (USA and Australia). Looking at the general characteristics of the women in the study conducted in the USA (494) gives a plausible explanation. The African women in this study had higher levels of education compared to the US-born women, as well as higher family income and lower smoking levels. They had also arrived quite recently into the USA (less than

5 years). Similarly, the lower mean BMI among women in the Australian study (491) may be associated with the Australian skilled migration system (501), which is a popular migration pathway for skilled workers migrating to Australia. Hence, it is possible that these women had a better social standing (e.g. higher levels of education and higher income) compared to African migrant women from the other HICs. We know from current literature that factors like low education levels, low income, smoking and high duration of residence in HICs are associated with higher BMI (see Chapter 4, Table 4). Thus, these characteristics may have contributed towards the lower mean BMI among African women in these two studies (491, 494) compared to the other studies.

Meta-regression analyses showed that sample size was significantly contributing to heterogeneity (p=0.01), but neither study design, study quality nor host country were contributing significantly to this (Appendix D). Other sociodemographic variables like maternal age, parity, marital status and education level could not be tested for as most studies either did not provide this information, or studies that did reported in ways that could not be combined. For example, some studies reported means while others reported % of women in different categories. It is not uncommon for studies on migrant populations to find high levels of heterogeneity which cannot be explained by potential confounding factors (501-503), and this may be due to differences in comparison groups, country contexts, study designs, characteristics of included and excluded populations or other methodological factors.

Sensitivity analyses for mean BMI in both pregnant and non-pregnant women demonstrated that meta-analyses were robust to the effect of any individual studies (Appendix D), and there was no evidence of publication bias (p=0.69).

5.3.1.2. Mean BMI results from studies not included in the meta-analysis

The 12 studies that were excluded from the meta-analysis reported on the mean BMI of African migrant women living in Australia (492), France (468, 469), Ireland (470), Israel (493), Italy (474), the Netherlands (419, 488), Norway (477), Spain (478), Sweden (480) and the UK (490) (Table 6). All but one study (419) reported on women from SSA.

The population means for the African migrant women in nine of the 12 studies were in the overweight or obese categories (seven studies reported mean BMI ranging between 25.11 to 28.6 Kg/m^2 (469, 474, 477, 478, 488, 490, 492); and two studies reported mean BMI of 30.0 and 31.2 Kg/m^2) (470, 476). Mean BMIs in the other 3 studies were within the recommended weight category, ranging between 24.1 to 24.7 Kg/m^2 (419, 468, 493). These values are similar to those reported in the studies included in the meta-analysis – the population mean BMI for African women in seven of the studies included the meta-analysis were in the overweight BMI category (ranging between 25.2 to 29.5 Kg/m^2); while four studies reported means within the recommended BMI category (range 24.6 to 24.9 Kg/m^2). From this summary, it shows that if it had been possible to include all studies in the meta-analysis, the mean BMI for African women would have been even higher, especially as the population means for African women in some of the studies that were left out were in the obese category. However, it is also not possible to determine how this would have compared with the mean BMI of non-African women, since the studies that were excluded did not have any comparison groups. So, even though the African women's BMI may have been increased, so too may that of non-African women, and this would have had little impact on the WMD.

One thing in common between the studies included in the meta-analysis and those excluded is the high proportion of African women having an overweight BMI. Out of 23 studies in total reporting on mean BMI in African women in this review, 16 showed African women having a

BMI above the recommended category, mostly overweight. However, we can see from Table 6 below that there is some level of variability in the data provided in some of these studies, given the standard deviations (SDs) reported. For example, Agyemang et al. (488) report a SD of 2.3, meaning that about 95% of the women in their study had a BMI close to their reported mean of 28.4 Kg/m2. On the other hand, Ahmed et al. (476) report a SD of 6.8, which implies that the women's BMI values were more spread out, so some were outside their reported mean of 30Kg/m2.

Table 6: Results on mean BMI from studies not included in the meta-analysis

Author, year	Study Country	Region, countries of origin & sample size	Mean BMI of African migrant women	BMI category
Nicolaou *et al.* 2008 (419)	Netherlands	North Africa; Morocco; N=104	24.1 (SD 4.1)	RW
Regev *et al.* 2012 (493)	Israel	SSA; Ethiopia; N=53	24.7 (SD 4.4)	RW
Roville-Sausse *et al.* 1998 (468)*	France	SSA; Senegal, Mali, Niger; N=129	24.5 (SD NR)	RW
Agyemang *et al.* 2009 (488)	Netherlands	SSA; Ghana; N=82	28.4 (SD 2.3)	OW
Cohen *et al.* 2017 (469)	France	SSA; Cameroon; N=28	28.4 (SD 5.4)	OW
Dominguez et al., 2008 (474)	Italy	SSA; Ivory Coast, Ghana, Nigeria, Mali, Benin; N=23	25.7 (4.9)	OW
Gele *et al.* 2013 (477)	Norway	SSA; Somalia; N=115	27.4 (SE 0.29)	OW
Gil *et al.* 2005 (478)	Spain	SSA; Equatorial Guinea; N=130	26.7 (SD 4.6)	OW
Kelly *et al.* 2009 (490)*	UK	Not specified; N=327	25.3 (SD NR)	OW
Saleh *et al.* 2002 (492)	Australia	SSA; Ghana; N=35	27.4 (SD 4.7)	OW
Ahmed *et al.* 2018 (476)	Norway	SSA; Somalia; N=111	30.0 (SD 6.8)	OB
Lindsay *et al.* 2014 (470)*	Ireland	SSA; Nigeria; N=58	31.2 (SD 4.9)	OB

Footnote: RW – Recommended weight; OW – Overweight; OB – Obese; *Study includes pregnant women; SD – Standard deviation; SE – Standard error; NR – not reported

As stated in section 5.3.1.1. above, North African women living in Africa are reported to have higher mean BMIs compared to women from SSA (20, 457). In this review however, no study reported North African women having obese mean BMI, while three studies on women from SSA reported women having obese BMI. Though very little data available, it could be that the regional differences in weight patterns observed in African countries change after women migrate to HICs, possibly with women from SSA having similar – or even higher – BMI compared to North African women. In addition to understanding differences in weight status between African and non-African women in HICs, knowing whether women from a particular region are more likely to have overweight or obese BMIs would be instrumental in addressing weight-related health risks and behaviours for that particular group.

Comparison of mean BMI between African migrant women living in HICs and African migrant women living in Africa

As described in section 4.6.8.1, the mean BMI of African migrant women obtained from all the studies included in this review were compared with WHO mean BMI estimates for African women living in Africa. African migrant women living in HICs had a significantly higher mean BMI (28.6 kg/m^2, 95%CI 25.8 to 27.9) compared to African women living in Africa (24.1 Kg/m^2, 95%CI 23.8 to 24.3), ($t(15) = 5.48$, $p<0.01$). By weight category, the mean BMI for African migrant women living in HICs as well as their 95% CIs were all within the overweight BMI category. Meanwhile, both the mean BMI and 95% CIs for women living in Africa were in the recommended BMI range. This finding supports the narrative that migration to HICs is associated with increased BMI and weight status (66). It was however not possible to assess changes in weight status before and after migration in the same women due to limited data. Only three studies included in this review (475, 492, 493) reported on changes in weight status in the same women, and they showed evidence of women having lower BMIs either before migration or upon arrival in the host country compared to their BMI at the time of the study. This finding suggests that further weight gain had occurred after migration.

5.3.2. Meta-analysis of overweight and obesity categories

Twenty-two studies (418, 471-476, 478-482, 484, 485, 487-489, 491, 493-495, 497) reported on overweight, obesity or overweight/obesity, and 13 of these studies (471, 473, 479, 481, 482, 484, 485, 487, 489, 491, 494, 495, 497) provided sufficient data to be included in the meta-analyses. The studies were conducted in five HICs: Australia (n=1) (491), Italy (n=2) (473), the Netherlands (n=6) (482, 484, 485, 487, 489, 497), Sweden (n=2) (479, 481), and the USA (494, 495). Ten studies (471, 473, 481, 484, 485, 487, 489, 494, 495, 497) were included in the meta-analysis for obesity in African women compared to non-African women; eight studies (471, 473, 481, 484, 485, 487, 489, 494, 497) were included in the meta-analysis for overweight; and all 13 studies (471, 473, 479, 481, 482, 484, 485, 487, 489, 491, 494, 495, 497) were analysed for combined overweight/obesity. Sample size for African women ranged from 19 to 11,268, with a total of 15,972 women; while non-African women ranged from 100 to 421,754, totaling 481,179 women.

5.3.2.1. Odds of obesity in African women compared to non-African women

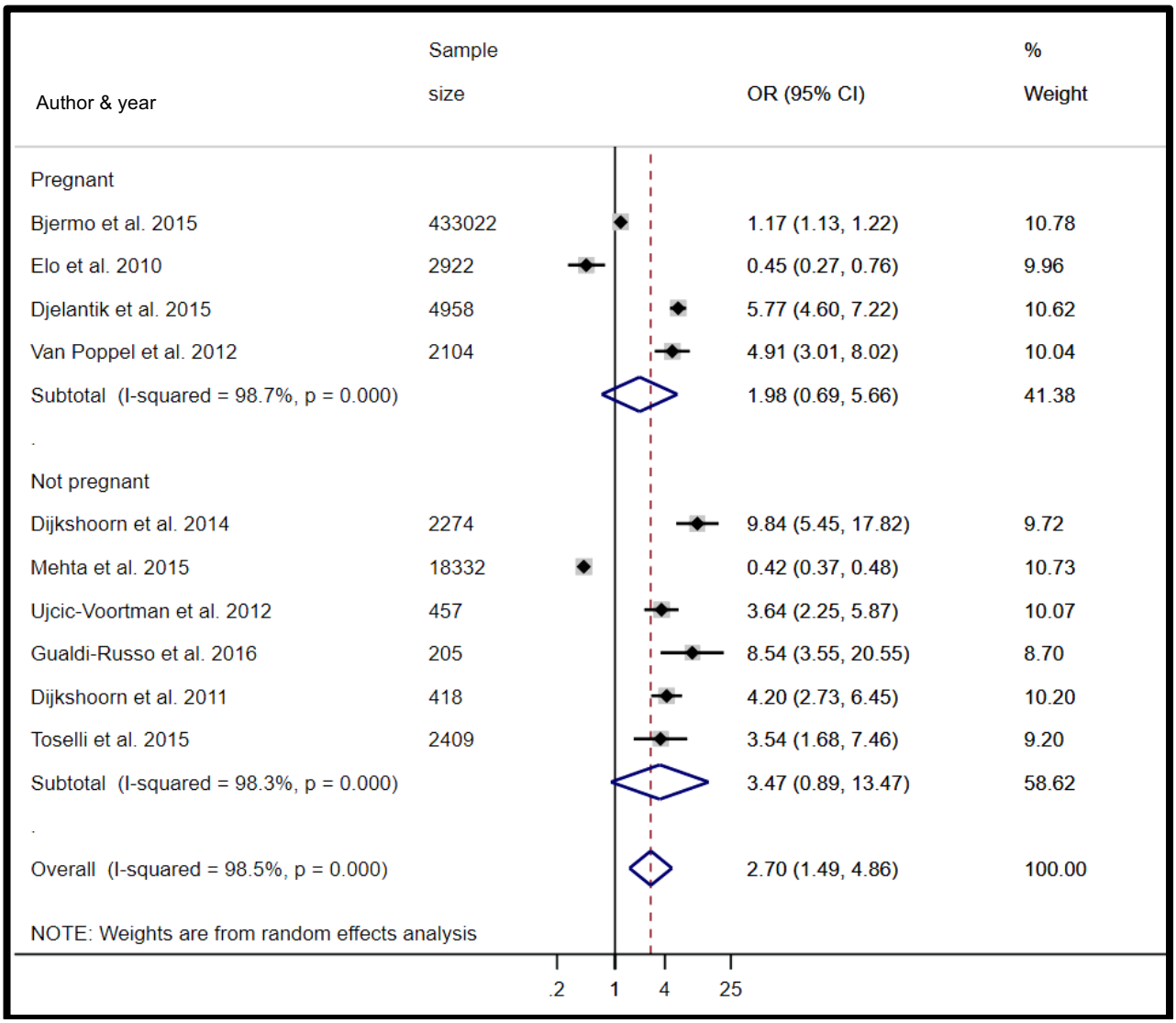
Four of the 10 studies analysed for obesity in African women compared to non-African women included pregnant women, with gestational ages between 8-16 weeks (481, 484, 487, 495). Overall analyses of pregnant and non-pregnant women showed significantly higher odds of obesity in African women compared to non-African women (OR 2.70, 95%CI 1.49 to 4.86), but there was no significant difference in OR for obesity in the sub-group analyses for either pregnant (OR 1.98, 95%CI 0.69 to 1.66) or non-pregnant women (OR 3.47, 95%CI 0.89 to 13.47) (Figure 8). Heterogeneity was significantly high for the overall analyses, and also when grouped by pregnancy status (I^2>90%, p<0.01).

When studies were sub-grouped by region of origin, the odds of obesity were significantly higher for women from North Africa compared to non-African women (OR 5.54, 95%CI 4.05 to 7.58), and heterogeneity reduced to medium (I^2=56.5% p=0.06) (Figure 9). Results were

not significant for three studies that did not specify the women's region of origin (OR 0.82, 95%CI 0.30 to 2.24) and they had significant heterogeneity (I^2>90%, p<0.01). Only one study included women from SSA and another study included women from both African regions, both showing significantly higher odds of obesity for African women (Figure 9).

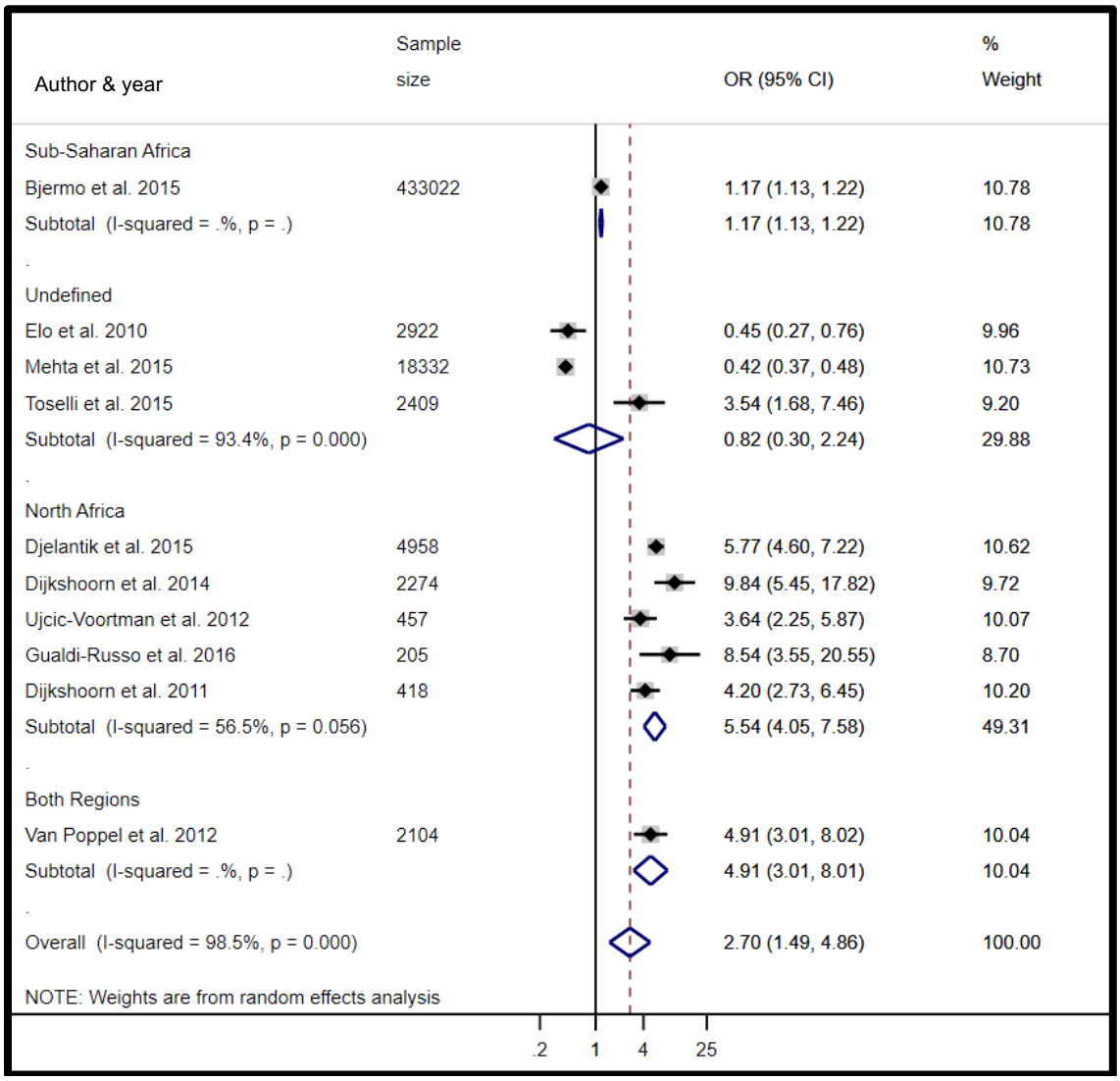
Further grouping studies on North African women by BMI assessment method reduced heterogeneity for studies reporting measured BMI, and it was no longer significant (I^2 =29.1%, p=0.24), while self-reported BMI studies had medium heterogeneity (I^2=63.3%, p=0.99) (Appendix E). For both assessment methods, ORs for obesity were significantly higher for African women compared to non-African women (OR measured 4.43, 95%CI 3.05 to 6.45; OR self-reported 7.00, 95%CI 4.23 to 11.58) (Appendix E). It is interesting to note here how the odds of obesity were rather higher for studies with self-reported BMI than those with measured BMI. One would expect this to be the other way round, given the evidence associating self-reported BMI with under-reporting. Perhaps, there could be differences in BMI reporting trends among different groups of women – for example, some women tending to over-report their BMI leading to an increased prevalence of overweight and obesity, while others under-report leading to a reduced prevalence. However, I was unable to find any literature on differences in BMI reporting trends by ethnic group.

Figure 8: Odds of obesity in African migrant women compared to non-African women - overall analysis sub-grouped by pregnancy status



Footnote: OR – odds ratio; CI – confidence interval

Figure 9: Odds of obesity in African migrant women compared to non-African women sub-grouped by African region of origin



Footnote: OR – odds ratio; CI – confidence interval; undefined – studies did not specify the African women's region of origin; both regions – studies included women from both North Africa and SSA

Neither sample size, study quality, study design nor host country were significantly contributing to heterogeneity (Appendix E). Sensitivity analyses showed that results were robust for obesity (Appendix E). However, Egger's test for small study effects produced a significant p-value (p=0.03) suggesting some evidence of publication bias (Appendix E). As explained in Chapter 5 section 4.6.8, a significant Egger's test indicates that smaller studies with positive results were more likely to be published.

Nine studies (418, 472, 474-476, 478, 480, 488, 493) reported data for obesity in African

migrant women but were excluded from the meta-analyses (Table 7). These were conducted in Israel (n=1) (493), Italy (n=3) (472, 474, 475), Norway (n=1) (476), Spain (n=1) (478), Sweden (n=1) (480) and the Netherlands (n=2) (419, 488). The women were mostly from SSA (six studies included women from SSA (474, 476, 478, 480, 488, 493), two included women from North Africa (419, 472) and one included women from both African regions (475)). The prevalence of obesity in these women ranged from 2.2% to 44.1% (Table 7). This range is lower compared to the values reported in the studies included in the meta-analysis, which ranged from 10.1% to 54.4%. This means the prevalence of obesity in African women would have been lower than currently shown if it had been possible to include all studies in the meta-analysis. However, it is impossible to determine if this would have made a difference to their odds of obesity compared to non-African women, as the excluded studies did not provide data on the prevalence of obesity in non-African women.

The meta-analysis also showed a high risk of obesity for North African women compared to non-African women, and, as seen with mean BMI in section 5.3.2, there was also a data gap for studies reporting on the prevalence of obesity in women from SSA. However, it may seem that the prevalence of obesity was higher among women from North Africa compared to those from SSA, given the ranges of obesity from the studies included in the meta-analysis (which mostly included North African women; range=10.1% to 54.4%) and the data from the studies that were excluded from the meta-analysis (which mostly reported on women from SSA; range=2.2% to 44.1%).

Table 7: Results on overweight, obesity and combined overweight/obesity from studies not included in the meta-analysis

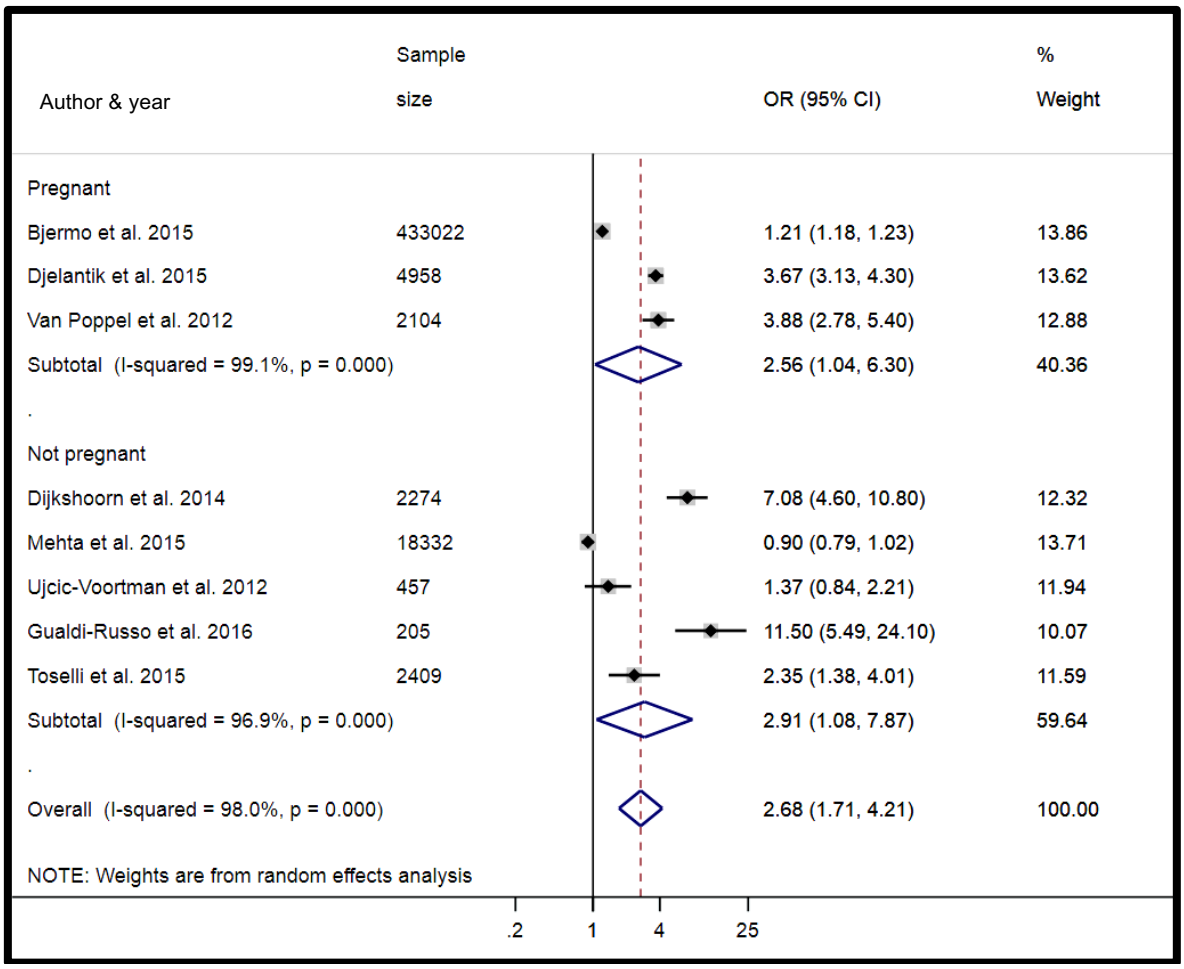
Author, year	Study Country	African region & countries of origin	Sample size	% OW	% OB	% OW/OB
Agyemang *et al.* 2009 (488)	Netherlands	SSA; Ghana	N=82	50.0	25.9	75.9
Ahmed *et al.* 2018 (480)	Norway	SSA; Somalia	N=111	NR	44.1	44.1
Aronsen et al. 2015 (480)	Sweden	SSA; Somalia	N=62	NR	NR	72.4
Casali *et al.* 2015 (475)*	Italy	North Africa & SSA (countries not specified)	N=97	35.0	16.5	51.5
Dominguez *et al.* 2008 (474)	Italy	SSA; Ivory Coast, Ghana, Nigeria, Mali, Benin	N=23	17.4	2.2	19.6
Gil et al. 2005 (478)	Spain	SSA; Equatorial Guinea	N=130	38.4	23.2	61.6
Gualdi-Russo et al. 2009 (472)	Italy	North Africa; Morocco	N=22	46.2	23.1	69.3
Nicolaou *et al.* 2008 (419)	Netherlands	North Africa; Morocco	N=104	23.1	11.5	34.6
Regev *et al.* 2012 (493)	Israel	SSA; Ethiopia	N=53	42.0	11.0	53.0

Footnote: OW – Overweight; OB – Obese OW/OB – combined overweight/obesity; *Study includes pregnant women; SSA – sub-Saharan Africa; NR – not reported

5.3.3. Odds of overweight in African women compared to non-African women

Three of the eight studies included in the meta-analysis for overweight included pregnant women (gestational age 8-16 weeks) (481, 484, 487). The odds of overweight were significantly higher in African women compared to non-African women in the overall analyses (OR 2.68, 95%CI 1.71 to 4.21), and also for both pregnant (OR 2.56, 95%CI 1.04 to 6.30) and non-pregnant (OR 2.91, 95%CI 1.08 to 7.87) African women compared to non-African women (Figure 10). Heterogeneity was significantly high for all analyses (overall I^2=98.0% p<0.01, pregnant I^2=99.1%, p<0.01 and non-pregnant I^2=96.9% p<0.01).

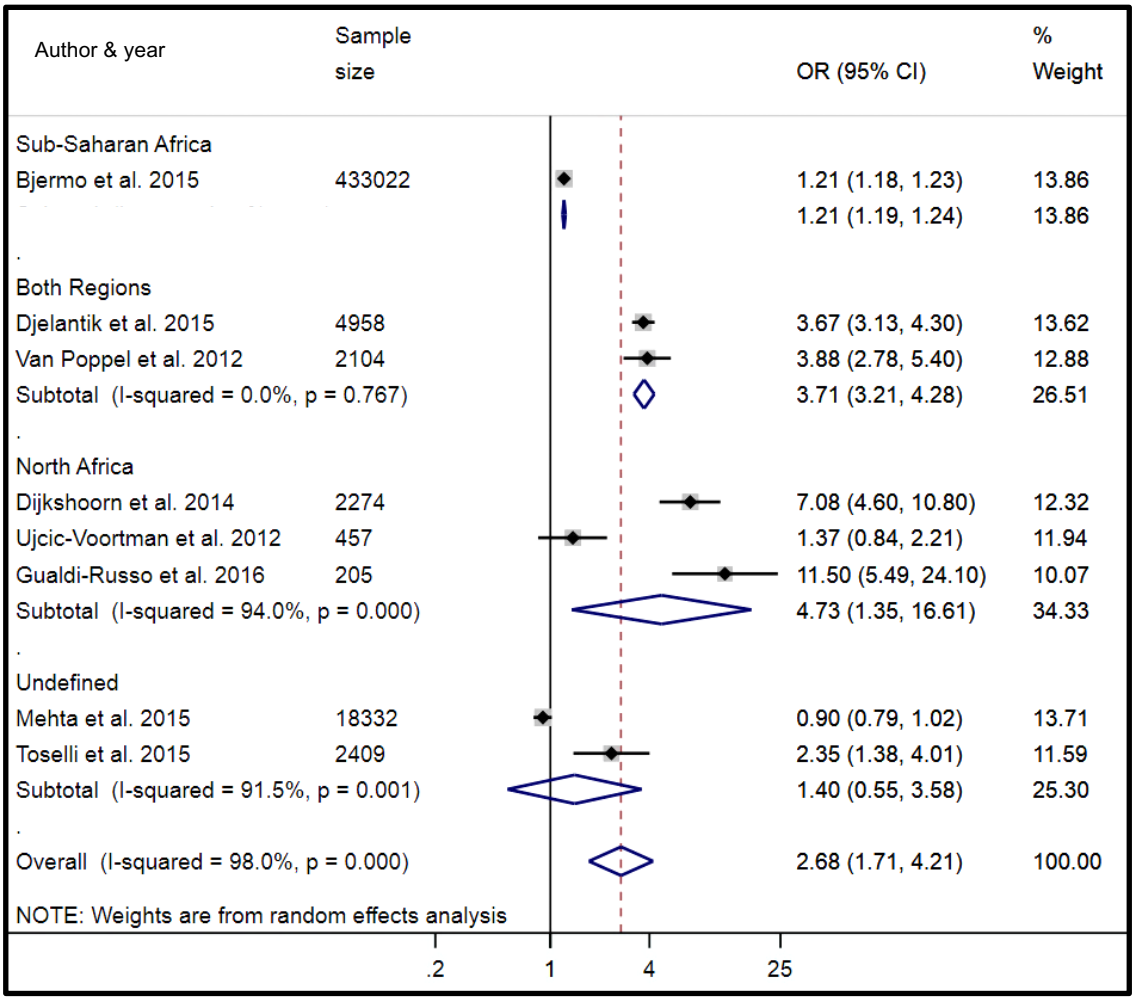
Figure 10: Odds of overweight in African migrant women compared to non-African women- overall analysis including both pregnant and non-pregnant women, sub-grouped by pregnancy status



Footnote: OR – odds ratio; CI – confidence interval

When sub-grouped by region of origin, North Africa women showed significantly higher odds of overweight compared to non-African women (OR 4.73, 95%CI 1.35 to 16.61), as did two studies that included women from both African regions (OR 3.71, 95%CI 3.21 to 4.28) (Figure 11). Results were not significant for two studies that did not define the women's region of origin, and only one study included women from SSA, showing significantly higher OR for African women (OR 1.21, 95%CI 1.19 to 1.24) (Figure 11). Heterogeneity was still significantly high after sub-grouping (I^2>90%, p<0.01), except for the two studies that included women from both African regions (I^2=0.0%, p=0.77).

Figure 11: Odds of overweight in African migrant women compared to non-African women sub-grouped by African region of origin



Footnote: OR – odds ratio; CI – confidence interval; undefined – studies did not specify the African women's region of origin; both regions – studies included women from both North Africa and SSA

Further sub-group analyses could not be performed for each African region by BMI assessment method due to small study numbers. Sample size, study quality, study design and host country were not found to be significantly contributing to heterogeneity (Appendix E). Results were robust for both studies on pregnant and non-pregnant women as the statistical significance did not change when any study was excluded (Appendix E). There was no evidence of publication bias (Egger's test p=0.23) (Appendix E).

The results for overweight are similar to those seen for obesity, with African women being twice as likely to be overweight (OR 2.68, 95%CI 1.71 to 4.21) compared to non-African women. The risk was even higher for women from North Africa (OR 4.73, 95%CI 1.35 to 16.61), although study numbers and sample sizes reduced considerably when grouped by region (only three studies reported on women from North Africa). Meanwhile, data were lacking on women from SSA. Heterogeneity was also very high, and not explained by the potential confounders I was able to explore in meta-regression.

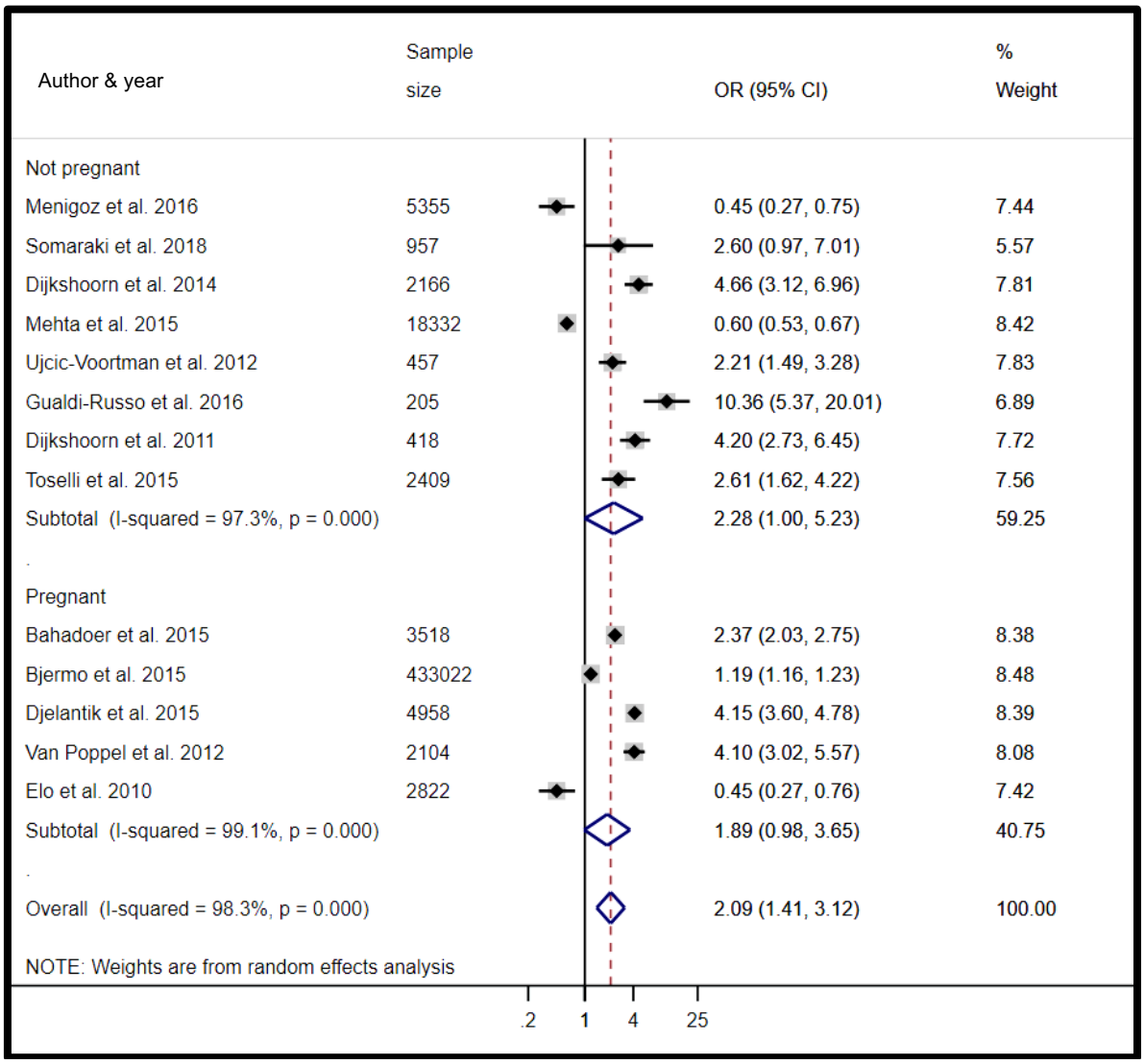
Nine studies that could not be included in the meta-analysis due to no comparison group reported on the prevalence of overweight in African migrant women, which ranged from 35 to 50% (Table 7). Meanwhile, the prevalence of overweight in the studies included in the meta-analysis ranged between 22.5% to 53.3%. The ranges were quite similar, meaning that there would probably not have been a big difference in the prevalence of overweight for African migrant women if it had been possible to include all the studies in the meta-analysis. However, the odds ratios would depend on the prevalence of overweight in non-African women, which cannot be determined since the studies excluded from the meta-anlaysis did not provide data on comparison groups.

5.3.4. Odds of combined overweight and obesity in African women compared to non-African women

Five of the 13 studies in the meta-analysis for overweight/obesity included pregnant women (gestational age 8-20 weeks) (481, 482, 484, 487, 495). ORs for combined overweight/obesity in the overall analysis found significantly higher odds for African women compared to non-African women (OR 2.09, 95%CI 1.41 to 3.12); and heterogeneity was significantly high (I^2 = 98.3%) (Figure 12). However, results were not significant for pregnant African women compared to pregnant non-African women (OR 1.89, 95%CI 0.98 to 3.65), while non-pregnant African women had higher odds of overweight/obesity compared to non-African women (OR

2.28, 95%CI 1.00 to 5.23) (Figure 12). Heterogeneity was significantly high for both analyses (I^2>90%)

Figure 12: Odds of combined overweight/obesity in African women compared to non-African women: overall analysis including both pregnant and non-pregnant women, sub-grouped by pregnancy status

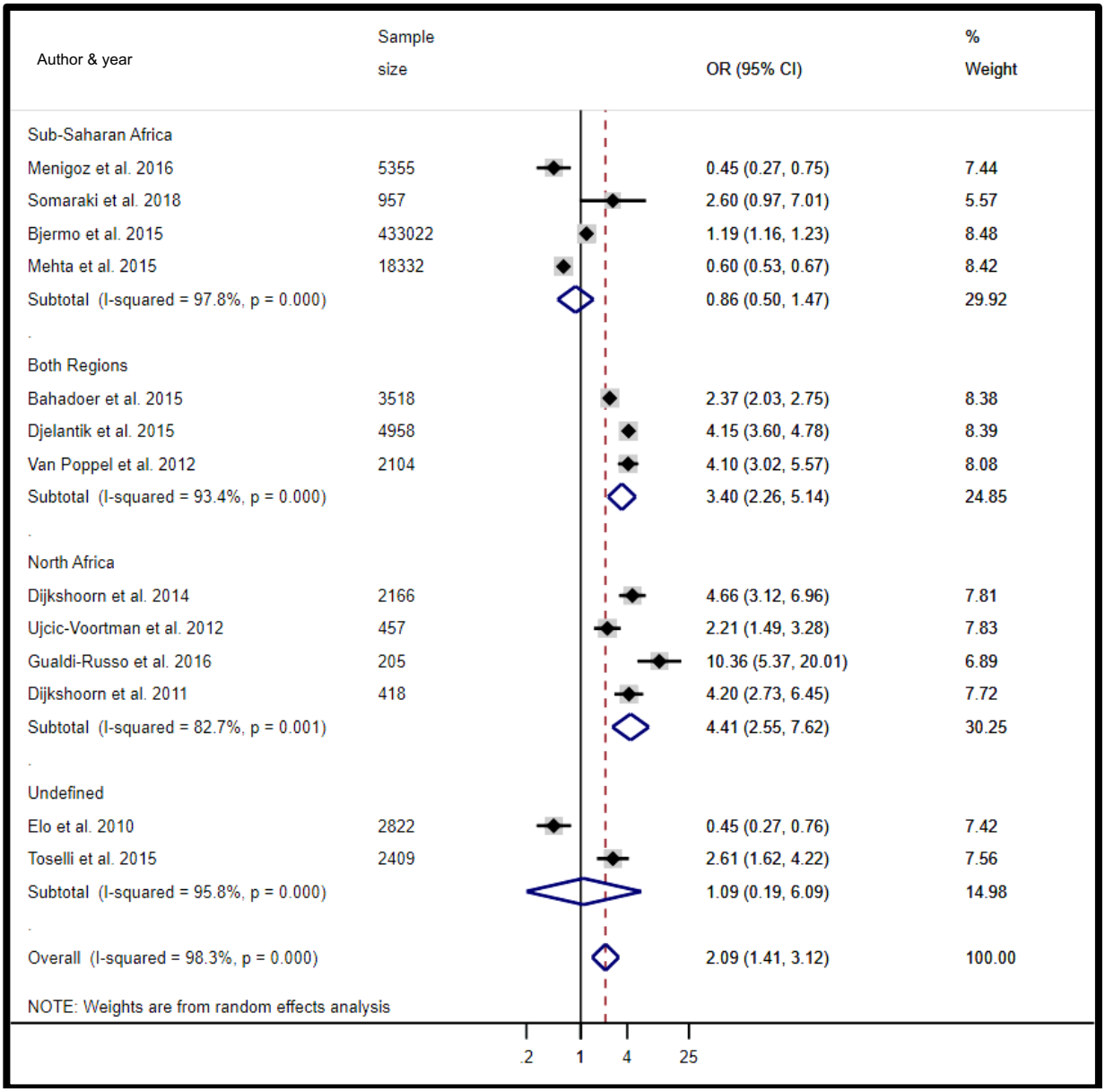


Footnote: OR – odds ratio; CI – confidence interval

Grouping studies by region of origin showed significantly higher odds of overweight/obesity for North African women compared to non-African women (OR 4.41, 95%CI 2.55 to 7.62), and also for studies that included women from both African regions (OR 3.40, 95%CI 2.26 to 5.14) (Figure 13). Meanwhile, results were not significant for women from SSA (OR 0.86, 95%CI 0.50 to 1.47), or for studies that did not specify women's region of origin (OR 1.09, 95%CI

0.19 to 6.09). There was significantly high heterogeneity across all sub-groups (I^2>80%, p<0.01).

Figure 13: Odds of combined overweight/obesity in African women compared to non-African women sub-grouped by African region of origin



Footnote: OR – odds ratio; CI – confidence interval; undefined – studies did not specify the African women's region of origin; both regions – studies included women from both North Africa and SSA

Further sub-grouping by BMI assessment method did not explain heterogeneity for any of the

groups (I^2>75%, p<0.01) (Appendix E). Sample size was found to be a significant contributor to heterogeneity (p<0.05), but not study quality, study design or host country (Appendix E). Results were robust for overweight/obesity in pregnant women but not for non-pregnant women as they were significant when any of two studies (481, 495) were excluded (Appendix E). There was no evidence of publication bias (Egger's test p=0.38).

Seven of the nine studies that were excluded from the meta-analyses for overweight/obesity showed that more than half of the African migrant women in their studies had an overweight/obese BMI (range 51.5% to 75.9%), while the prevalence in the remaining three studies ranged from 34.6% to 44.1% (Appendix E). Meanwhile, the prevalence of overweight/obesity among African migrant women in the studies included in the meta-analysis ranged from 32.6% to 78%. Like the trend seen for studies on overweight, these ranges are quite similar and would not have made a big difference to the prevalence of overweight/obesity for African migrant women if all the studies had been included in the meta-analysis. It is also not possible to determine how this will compare with overweight/obesity in non-African women since this data was not provided by studies excluded from the meta-analysis.

5.4. FACTORS ASSOCIATED WITH INCREASED BMI, OVERWEIGHT AND OBESITY IN AFRICAN MIGRANT WOMEN

(a) Weight-related behaviours

One study (475) reported an association between dietary behaviours and weight status, showing that increased BMI in African migrant women was associated with increased consumption of cheese, snacks and sweets after migration (OR 2.92, 95% CI 1.15-7.43). Changes in dietary pattern after migration were also said to result to an increased risk of overweight (data not reported) (492). Only one study reported an association between PA and weight status, where reduced PA after migration was associated with higher BMI (469).

(a) Migration-related factors

Only six studies reported on associations between African women's duration of residence in HICs and their weight status, and all six found that the women's mean BMI or risk of overweight and obesity increased significantly with increasing number of years spent in a HIC (474, 475, 486, 491-493). One study also found a significant association between women's age at arrival in HICs and weight status, showing that women who arrived at younger ages were more likely to develop overweight or obesity (415).

(b) Sociodemographic factors

Seven studies (469, 475, 476, 482, 486, 489, 493) reported on four sociodemographic variables, which were age, education, marital status and income. Five studies (469, 475, 476, 482, 493) found that women's weights increased with advancing age, four (475, 476, 482, 489) reported increased odds of overweight and obesity for women with low educational levels and one study found that being married was significantly associated with overweight and obesity (482). However, one study had contradicting results, with no association seen for either age, marital status or education (486). There was no significant association reported between

income and weight status in two studies (482, 486).

(c) Weight perceptions

Two studies in this review (418, 470) also reported a high prevalence of weight under-estimation among African migrant women, although the studies did not explore any associations between this behaviour and the women's weights.

SECTION II: RESULTS ON CHILD WEIGHT

5.5. DESCRIPTION OF STUDIES INCLUDED IN REVIEW ON CHILD WEIGHT

Searches identified a total of 5320 citations. After the exclusion of duplicates and screening of titles, abstracts and full texts, 29 studies met the inclusion criteria for this review (Figure 10). The characteristics of all included studies are presented in Table 8. There were 29 studies and 31 countries as two of the studies (505, 506) each reported on different populations in two different HICs. Most of the studies were conducted in European countries (n=23): Belgium (n=3) (467, 505, 507), France (n=3) (468, 505, 506), Italy (n=2) (244, 473), Netherlands (*n*=7) (483, 508-513), Norway (n=2) (514, 515), Spain (n=3) (506, 516, 517), Sweden (n=2) (479, 518), Switzerland (519) and the UK (n=2) (490, 520). One study was conducted in Australia (521), one in Israel (522), and four in the USA (523-526). For simplicity, children of African migrant women are henceforth referred to as African children, while children born to non-African women from the host country are referred to as non-African children.

Twenty-two studies reported the region of maternal origin of the African children (based on mother's country of birth): 11 included children born to mothers from North Africa (467, 505, 507, 508, 510-514, 517, 518), eight from SSA (468, 479, 506, 515, 521-523, 526) and three included children from both regions (483, 509, 516). Seven studies did not define the region of origin of their participants (244, 473, 490, 519, 520, 524, 525). Sample sizes for African children ranged from 56 to 97,663; giving a total of 223,087 children among the 28 included studies. Sample sizes for non-African children ranged from 155 to 1,061,924, giving a total of 4,230,993 children. Nineteen studies reported on birth weight outcomes and 10 studies included children aged two to 13 years. Assessment of study quality resulted in 21 studies being rated good quality and eight as fair quality (Table 8 and Appendix C). There were no poor quality studies.

Figure 14: PRISMA flow chart showing selection of studies for inclusion in systematic review on child weight

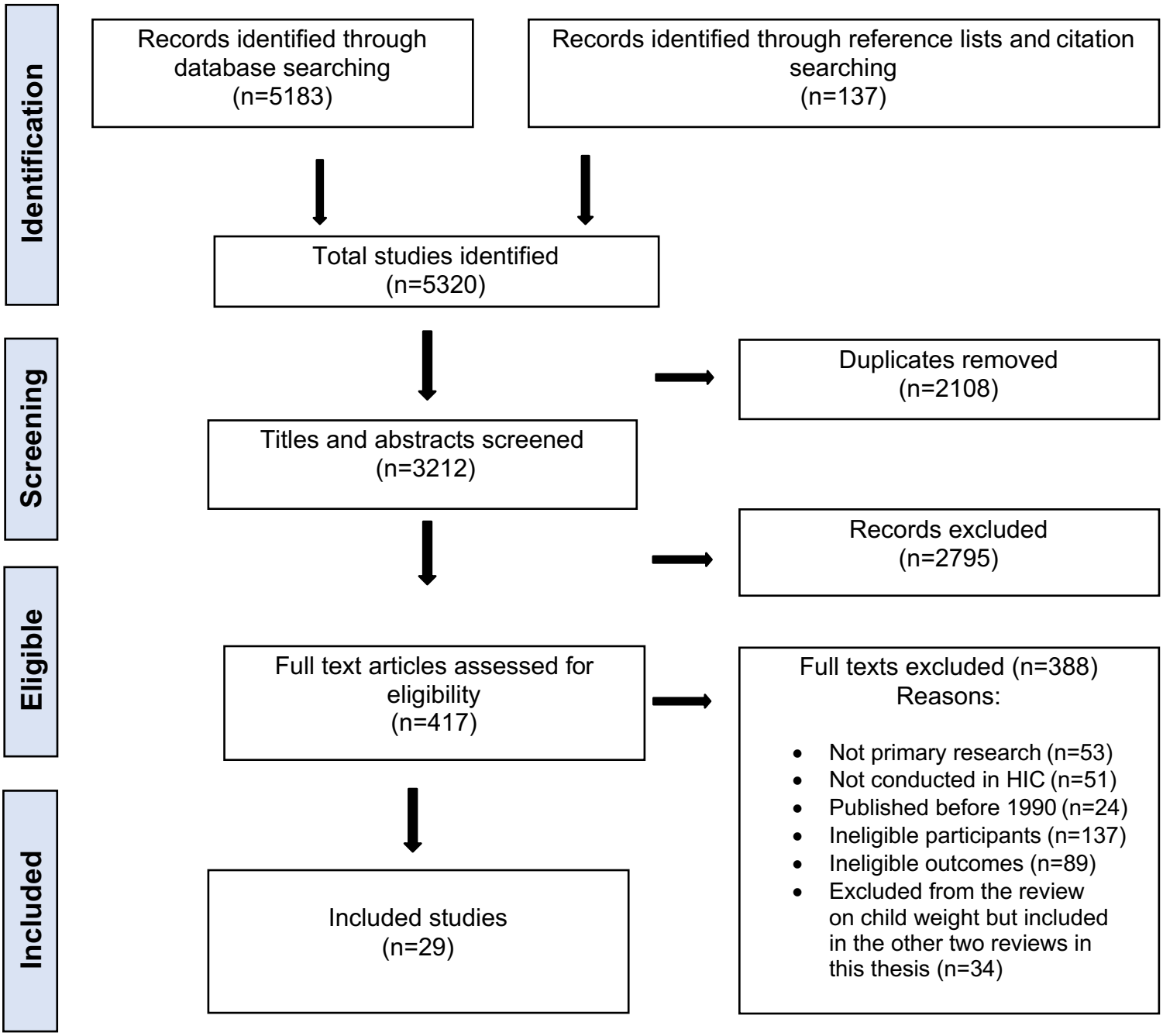


Table 8: Characteristics of studies included in the review on child weight

Author, year & reference number	Study design	Data source	Region (countries of origin) of African children	Sample size of African children	Study country	Sample size of non-African children	Child age groups or mean age (years)	Study Quality
Bakken *et al.* 2015 (515)	Prospective cohort	Medical Birth Registry of Norway	SSA (Somalia)	n=622	Norway	n=6,826	Newborn	Good
Belihu *et al.* 2016 (527)	Cross-sectional	Victorian Perinatal Data Collection database	SSA (Somali, Ethiopia, Eritrea, Sudan)	n=4,812	Australia	n=427,755	Newborn	Good
Buekens *et al*. 1998 (507)	Retrospective cohort	Single live birth certificate records, Belgium	North Africa (Algeria, Morocco, and Tunisia)	n=34,686	Belgium	n=804,286	Newborn	Fair
Calderon-Margalit *et al.* 2015 (522)	Cross-sectional	Birth records from Assaf-Harofeh Medical Centre	SSA (Ethiopia)	n=28,626	Israel	n=27,307	Newborn	Fair
David *et al.* 1997 (523)	Retrospective cohort	Birth certificates from the Illinois Department of Public Health	SSA (Ghana, Nigeria)	n=3,135	USA	n=44,046	Newborn	Fair
De Hoog *et al.* 2011 (509)	Prospective cohort	Amsterdam Born Child and their Development study	North Africa (Morocco), SSA*	n=483	Netherlands	n=1,718	Newborn	Good
Fang *et al.* 1999 (524)	Retrospective cohort	New York City birth records	Not specified	n=9,362	USA	n=173,069	Newborn	Good
Guendelman *et al.* 1999 (505)**	Retrospective cohort	Birth records for 1992 (Belgium) National survey data for 1995 (France)	North Africa*	France n=632 Belgium n=4,623	France and Belgium	France n=1,1170 Belgium n=10,3345	Newborn	Good
Harding *et al.* 2006 (520)	Retrospective cohort	The Longitudinal Study	Not specified	n=224	UK	n=52,554	Newborn	Good

Author, year & reference number	Study design	Data source	Region (countries of origin) of African children	Sample size of African children	Study country	Sample size of non-African children	Child age groups or mean age (years)	Study Quality
Johnson *et al.* 2004 (526)	Retrospective cohort	Birth Events Records database	SSA (Somalia)	n=579	USA	n=2,453	Newborn	Good
Juarez *et al.* 2014 (516)	Cross-sectional	Spanish Vital Statistics	SSA*, NA*	n=97,663	Spain	n=1,061,924	Newborn	Good
Kelly *et al.* 2009 (490)	Retrospective cohort	UK Millennium Cohort Study	Not specified	n=327	UK	n=14,068	Newborn	Good
Prado *et al.* 2004 (506)**	Cross-sectional	Birth records from Lariboisière hospital (France) and Gomez hospital (Spain)	SSA*	France n=155 Spain n=56	France and Spain	France n=155 Spain n=428	Newborn	Good
Restrepo-Mesa *et al.* 2015 (517)	Retrospective cohort	National Institute of Statistics of Spain	North Africa (Morocco)	n=27,072	Spain	n=599,660	Newborn	Good
Rovillé-Sausse *et al.* 1998 (468)	Prospective cohort	Two populations of children born and raised in Paris	SSA (Senegal, Mali, Niger)	n=129	France	n=320	Newborn	Fair
Troe *et al.* 2007 (513)	Retrospective cohort	Generation R Study	North Africa (Morocco)	n=490	Netherlands	n=3659	Newborn	Good
Vahratian *et al.* 2004 (467)	Prospective cohort	Hospital-based cohort of 1,162 women	North Africa*	n=354	Belgium	n=808	Newborn	Good
Vang *et al.* 2013 (525)	Retrospective cohort	Birth records from the State of New Jersey Department of Health and Senior Services	Not specified	n=6,100	USA	n=58,748	Newborn	Good
Vangen *et al.* 2002 (514)	Retrospective cohort	Medical Birth Registry of Norway	North Africa (Morocco)	n=1,461	Norway	n=808,658	Newborn	Fair
De Hoog *et al.* 2012 (483)	Cross-sectional	Amsterdam Born Child and their Development study	North Africa (Morocco), SSA*	n=345	Netherlands	n=1,744	5–7	Good

Author, year & reference number	Study design	Data source	Region (countries of origin) of African children	Sample size of African children	Study country	Sample size of non-African children	Child age groups or mean age (years)	Study Quality
De Wilde *et al.* 2009 (508)	Cross-sectional	Child Health Care records, Netherlands	North Africa (Morocco)	n=690	Netherlands	n=2,921	3–6	Good
Jeannot *et al.* 2015 (519)	Cross-sectional	Children attending Public School of Geneva	Not specified	n=331	Switzerland	n=5477	5-14	Fair
Khanolkar *et al.* 2015 (518)	Cross-sectional	Children born during 2000–2004 and registered as residents in Uppsala, Sweden	North Africa*	n=97	Sweden	n=9,342	4.8	Good
Labree *et al.* 2015 (511)	Cross-sectional	IVO Nutrition and Physical Activity Child Cohort study	North Africa (Morocco)	n=66	Netherlands	n=1,546	8–9	Good
Snoek *at al.* 2007 (512)	Cross-sectional	55 secondary schools from four regions in the Netherlands	North Africa (Morocco)	n=90	Netherlands	n=7239	11–14	Fair
Somaraki *et al.* 2018 (479)	Cross-sectional	Swedish Population Registry	SSA (Burundi, Congo, Eritrea, Ethiopia, Gambia, Ghana, Ivory Coast, Liberia, Somalia, Tanzania)	n=16	Sweden	n=941	3–8	Fair
Toselli *et al.* 2014 (244)	Cross-sectional	Children attending primary school in the Emilia-Romagna region (Northern Italy)	Not specified	n=60	Italy	n=1,208	8.3	Good
Toselli *et al.* 2015 (473)	Cross-sectional	SoNIA study - Nutritional surveillance for children and adolescents	Not specified	n=72	Italy	n=2,337	5–6	Good
Veldhuis *et al.* 2013 (510)	Cross-sectional	“Be active, eat right” study	North Africa (Morocco)	n=152	Netherlands	n=7,302	5.8	Good

Footnote: *African countries of origin not reported **study reports two data sets in two different HICs; SD – standard deviation; SSA – sub-Saharan Africa

5.6. META-ANALYSIS RESULTS ON CHILD WEIGHT

Ten studies provided data for childhood overweight/ obesity (244, 473, 479, 483, 508, 510, 512, 518, 519, 528). All studies measured children's BMI and classified according to the International Obesity Task Force criteria (IOTF). The IOTF provides international BMI ranges for overweight and obesity by age and sex for children aged 2 to 18 (overweight/obese = BMI≥25 kg/m^2, overweight = BMI 25-29.9 kg/m^2 and obese = BMI≥30 kg/m^2) (529). These studies were conducted in four countries (Italy, Netherlands, Sweden and Switzerland).

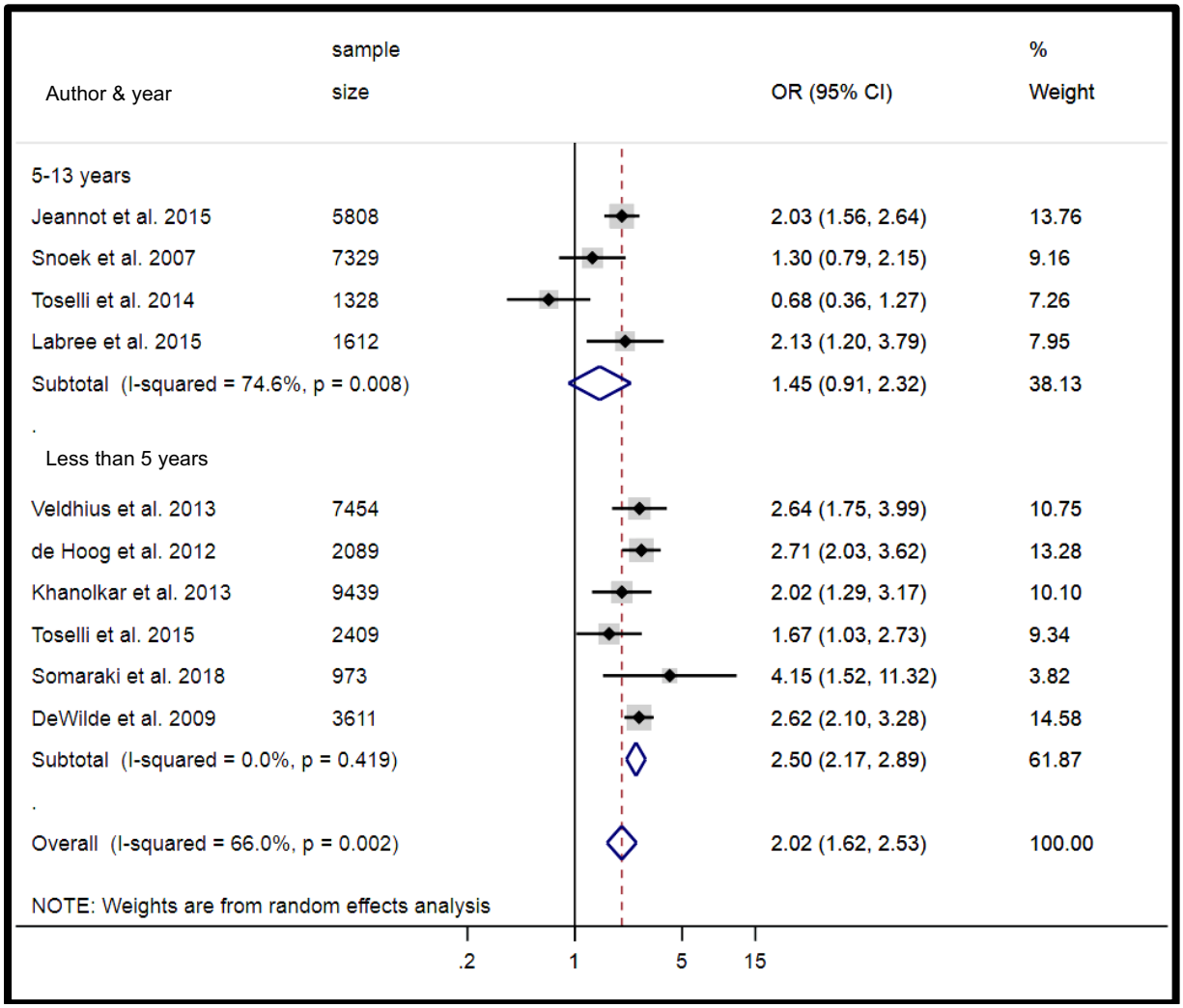
5.6.1. Odds of overweight/obesity in African children compared to non-African children

All 10 studies included in the meta-analysis were analysed for combined overweight/obesity in 44,177 children aged 2-13 (2,264 African and 41,913 non-African children). African children had higher odds of combined overweight/obesity than non-African children (OR 2.02, 95%CI 1.62 to 2.53), and there was medium heterogeneity (I^2=66.0%, p=0.002) (Figure 15). When analysed by child age, African children aged less than 5 years had higher odds of overweight/obesity than non-African children of the same age group (OR 2.50, 95%CI 2.17 to 2.89), and there was no heterogeneity (I^2=0.0%, p=0.42) (Figure 15). Results were not significant for children aged 5-13 years (OR 1.45, 95%CI 0.91 to 2.32) and there was medium heterogeneity (I^2=74.6%, p=0.008).

Sub-grouping the studies by maternal region of origin showed significantly higher odds of combined overweight/obesity for North African women children compared to non-African children (OR 2.19, 95%CI 1.62 to 2.97) and heterogeneity was reduced, though still medium (I^2 = 55.2%, p=0.08) (Figure 16). Two studies that included children from both African regions also showed significantly higher odds of overweight/obesity for African children (OR 2.47, 95%CI 1.89 to 3.23), with low heterogeneity (I^2 = 14.2%, p=0.28). Results were not significant for three studies that did not specify the children's region

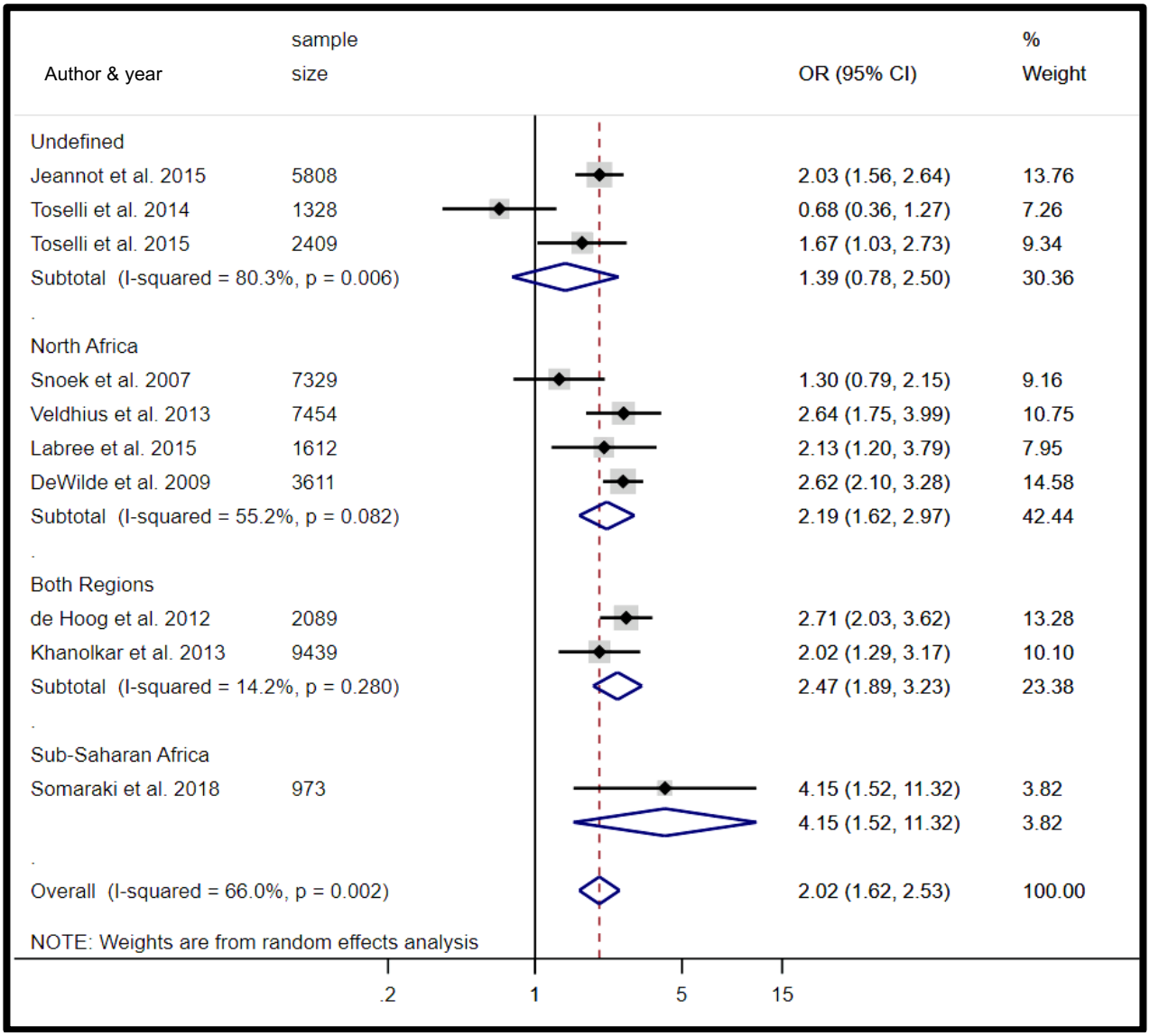
of origin (OR 1.02, 95%CI 0.37 to 2.80) and heterogeneity was significantly high (I^2 = 80.3%, p=0.006) (Figure 16). Only one study included children from SSA, and they had higher odds of obesity compared to non-African children (OR 4.15, 95% CI 1.52 to 11.32).

Figure 15: Odds of combined overweight/obesity in African children compared to non-African children: overall analysis of all children, sub-grouped by child age group



Footnote: OR = odds ratio; CI = confidence interval

Figure 16: Odds of combined overweight/obesity in African children compared to non-African children sub-grouped by African region of origin



Footnote: OR – odds ratio; CI – confidence interval; undefined – studies did not specify the African children's region of origin; both regions – studies included women from both North Africa and SSA

Meta-regression analyses showed that sample size, study quality and host country were not significantly contributing to heterogeneity (Appendix F). There was insufficient data to test for the influence of maternal age, maternal BMI, mother's duration of residence in the HIC and sex of the child on heterogeneity. Three studies provided data on childhood overweight/obesity in African children by sex of the child (473, 508, 530), and there was no significant difference for boys and girls (reference group=boys, OR for girls = 1.02, 95%CI

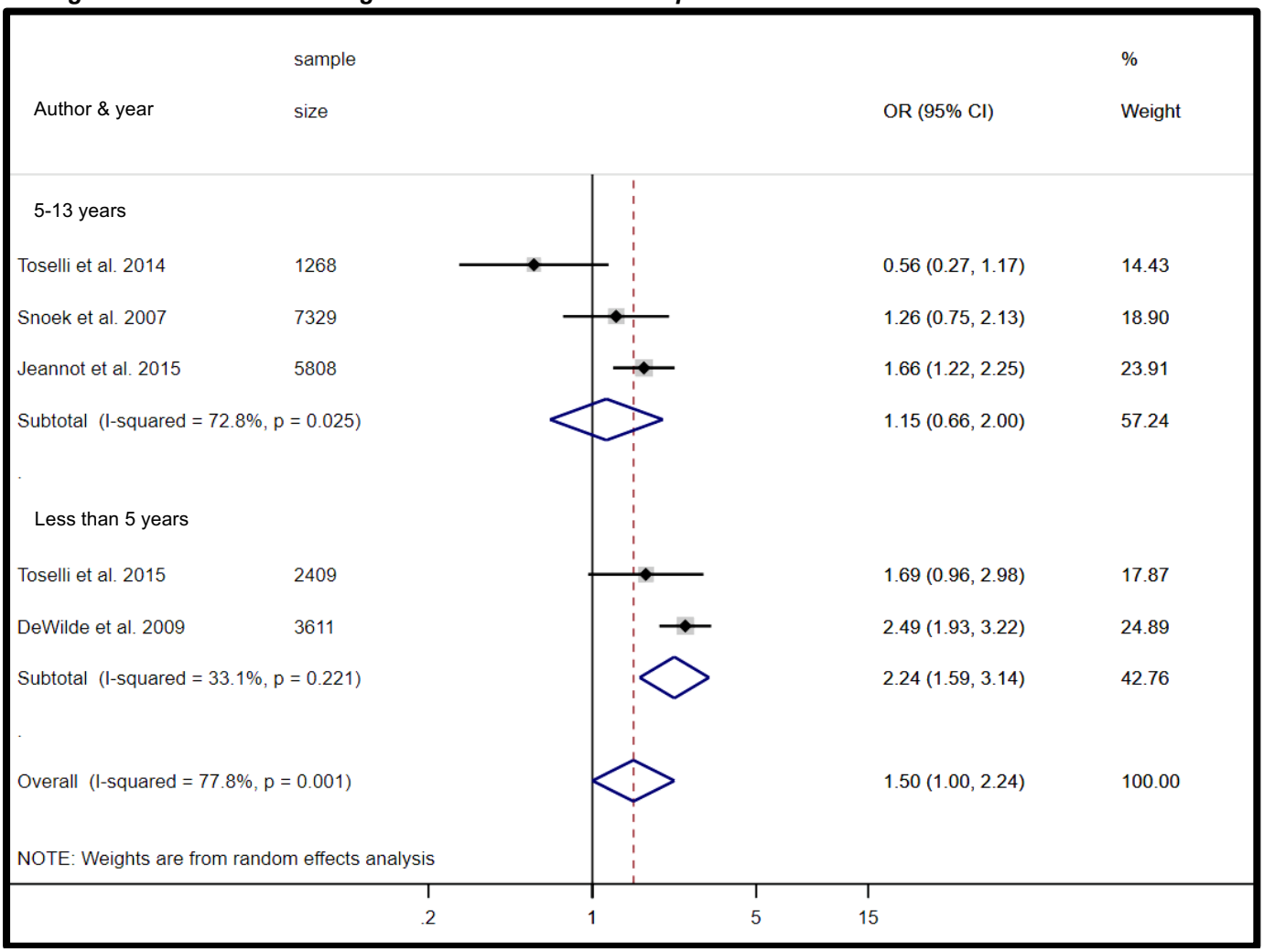
0.99 to 1.05) (Appendix F). Sensitivity analyses showed that results were robust for combined

overweight/obesity and there was no evidence of publication bias (Egger's test for small study effects p=0.31) (Appendix F).

5.6.2. Odds of overweight and obesity in African children compared to non-African children

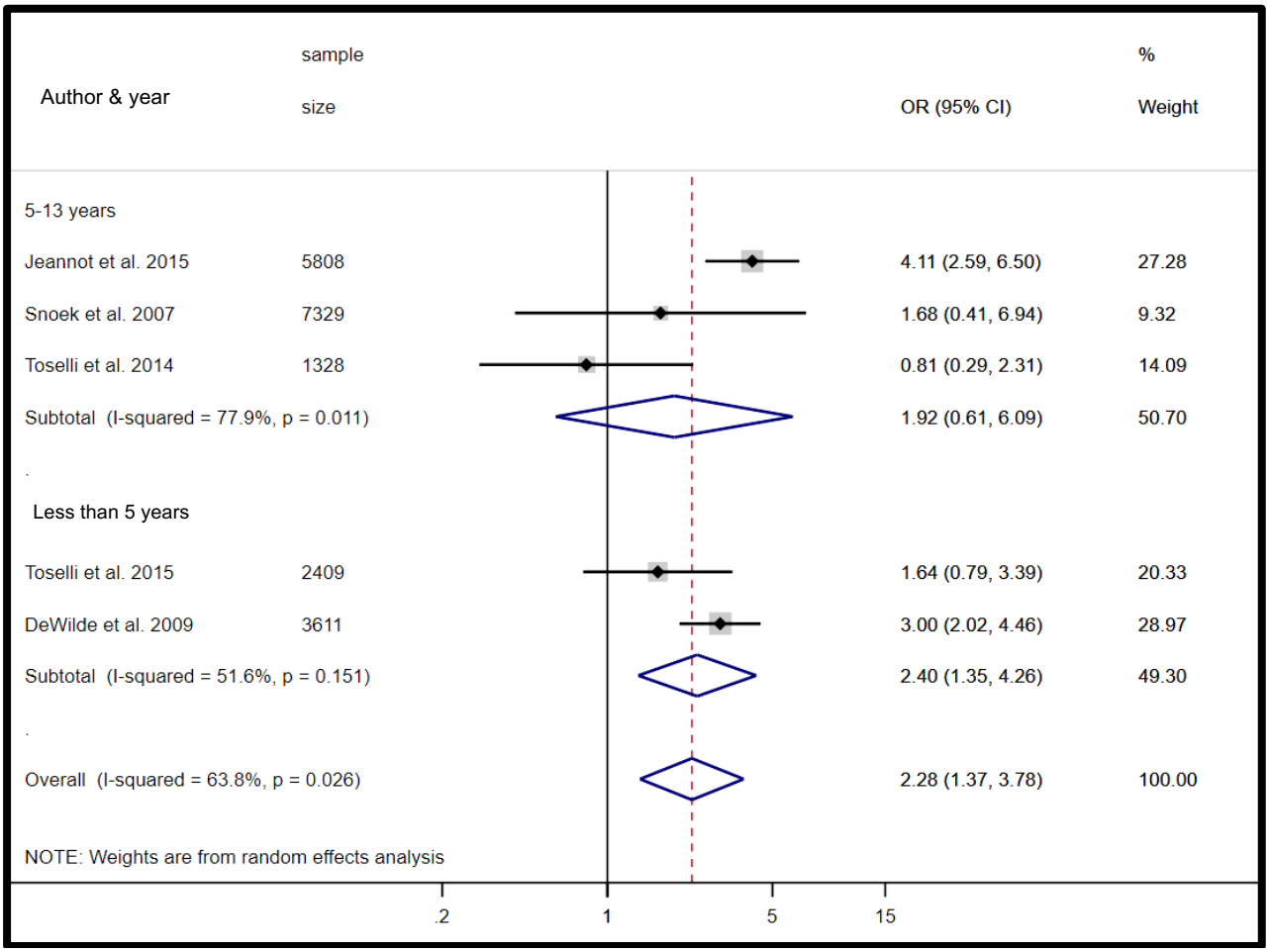
Five studies (244, 473, 508, 512, 519) provided data separately for childhood overweight and obesity involving 20,425 children (1,243 African and 19,182 non-African). Two studies included children aged less than 5 years and three included children aged 5-13 years. African children had higher odds of both overweight (OR 1.50 95%CI 1.00 to 2.24) (Figure 17) and obesity (OR 2.28 95%CI 1.37 to 3.78) (Figure 18) compared to non-African children in overall analyses. Heterogeneity was significantly high for overweight (I^2=77.8%; p<0.01), and medium for obesity (I^2=63.8%; p=0.03). In the age sub-group analysis, results for both overweight and obesity were significant for children aged less than 5 years, with higher odds for African children compared to non-African children (OR overweight 2.24, 95%CI 1.59 to 3.14; OR obesity 2.40 95%CI 1.35 to 4.26) (Figures 17 and 18). Heterogeneity was reduced to low for overweight (I^2=33.1%; p=0.2) (Figure 17), and medium for obesity (I^2=51.6%; p=0.15) (Figure 18). Meanwhile, there was no significant difference in odds of overweight or obesity for children aged 5-13 years (Figures 17 and 18) and heterogeneity was not reduced.

Figure 17: Odds of overweight in African children compared to non-African children



Footnote: OR – odds ratio; CI – confidence interval

Figure 18: Odds of obesity in African children compared to non-African children



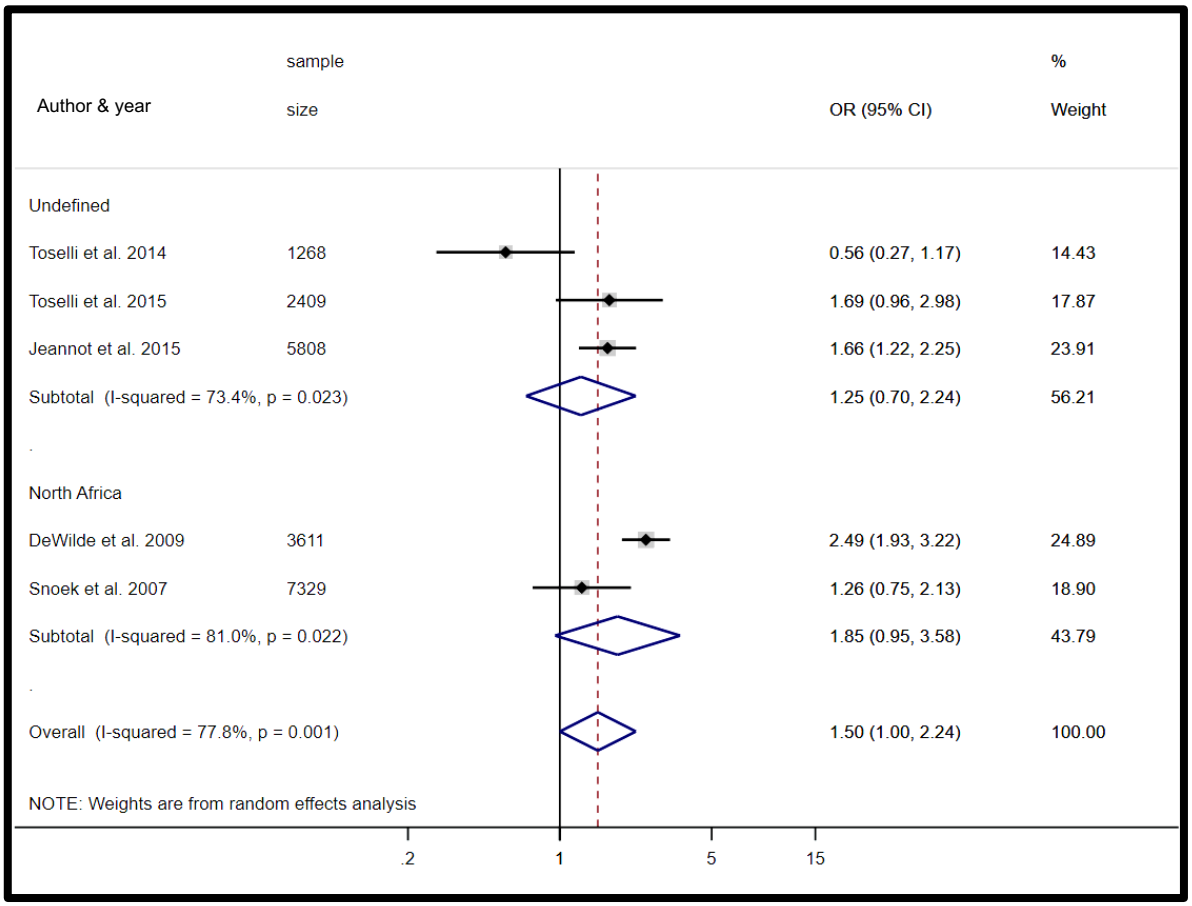
Footnote: OR – odds ratio; CI – confidence interval

Neither sample size, study quality nor host country were significantly contributing to heterogeneity for both child overweight and obesity meta-analyses (Appendix F). Sensitivity analyses showed that results were not robust for either outcome, as the pooled ORs were not significant when any one of two studies (473, 508) were removed (Appendix F). There was no evidence of publication bias for both outcomes (Egger's test for small study effects p=0.26 for overweight, p=0.07 for obesity) (Appendix F).

Two of the five studies reporting child overweight and obesity included North African children (508, 512) and the other three studies (244, 473, 519) did not specify their region of origin.

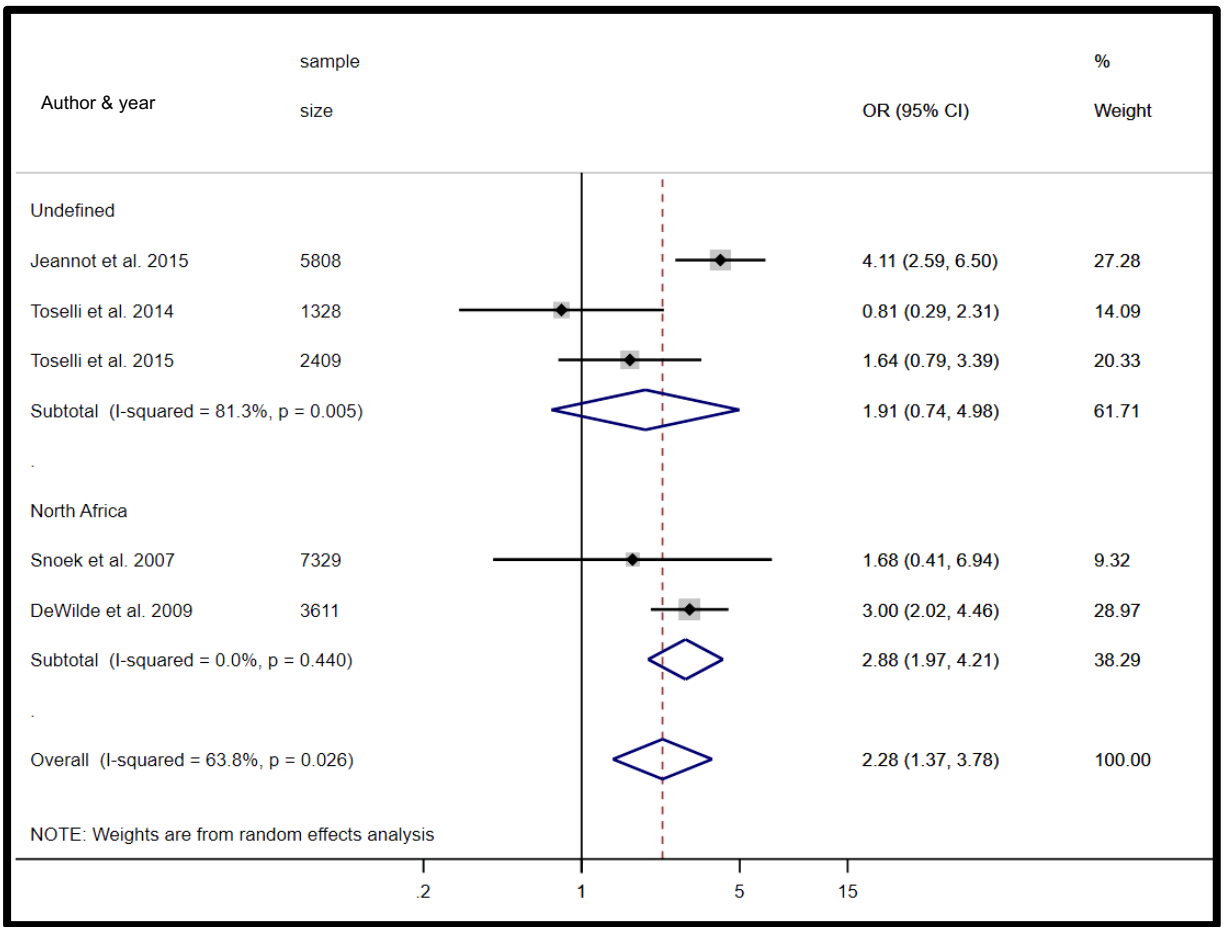
There were no significant differences in child overweight between African and non-African children for either regional sub-groups, and likewise for child obesity among the studies that did not specify their regions of origin (Figures 19 and 20). However, the two studies reporting on children from North Africa showed significantly higher odds of obesity for African children compared to non-African children, and there was no heterogeneity between them (I^2=0, p=0.44) (Figure 20).

Figure 19: Odds of overweight in African children compared to non-African children, sub-grouped by maternal region of origin



Footnote: OR – odds ratio; CI – confidence interval; undefined – studies did not specify the African children's region of origin

Figure 20: Odds of obesity in African children compared to non-African children, sub-grouped by maternal region of origin



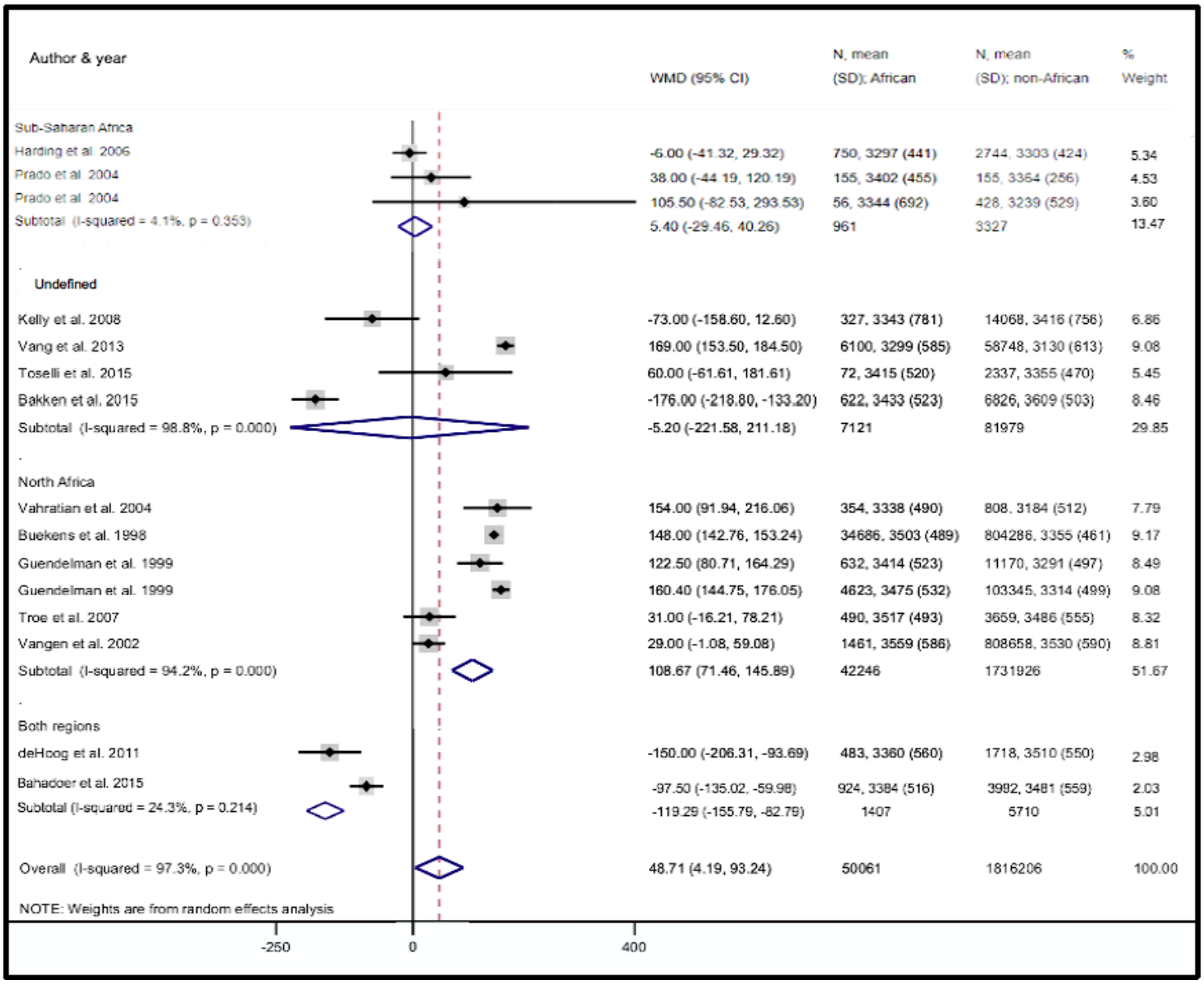
Footnote: OR – odds ratio; CI – confidence interval; undefined – studies did not specify the African children's region of origin

5.6.3. Mean birth weights of African children compared to non-African children

Fourteen studies (467, 473, 490, 505-507, 509, 513-515, 523-525) reported on mean birth weight and 11 were included in the meta-analysis. Three studies (468, 523, 524) which did not provide sufficient summary data were excluded, and are described narratively. There were 13 data sets in the meta-analysis, as two studies (505, 506) provided data for African and non- African children in two different HICs. The analysis compared weight outcomes in 4,097,612 children (176,375 African and 3,921,237 non-African).

Mean birth weight was significantly higher for African children compared to non-African children (WMD 48.71g, 95%CI 4.19g to 93.24g) (Figure 21). Heterogeneity across studies was significantly high (I^2=97.3%, p<0.01). When sub-grouped by African mother's region of origin, North African children had significantly higher mean birth weights compared to non-African children (WMD 108.67, 95%CI 71.46g to 145.89g), and heterogeneity was still significant (I^2=94.2%, p<0.01) (Figure 21). Meanwhile, results were not significant for children whose mothers were from SSA (WMD 5.40g, 95%CI -29.46g to 40.26g) and heterogeneity was also not significant (I^2=4.1%, p=0.35) (Figure 21). Results from four studies which did not specify maternal region of origin also did not reach statistical significance (WMD -5.20g, 95%CI -221.58g to 221.18g), same as two studies that included children from both African regions (-119.29g, 95% CI -155.79g to -82.79g; low heterogeneity (I^2=24.3, p=0.21)) (Figure 21).

Figure 21: Mean birthweight for African children compared to non-African children



Footnote: WMD – weighted mean difference; N – sample size, mean – mean BMI, SD – standard deviation; undefined – studies did not specify the African children's region of origin; both regions – studies included children born to women from both North Africa and SSA

Meta-regression analyses showed that study year and host country were significantly contributing to heterogeneity ($p<0.05$), but not sample size or study quality (Appendix G). As most studies did not provide data on maternal age, maternal BMI, mother's duration of residence in the HIC and sex of the child, it was not possible to test for the contribution of these factors to heterogeneity. Sensitivity analyses showed that the results for birthweight

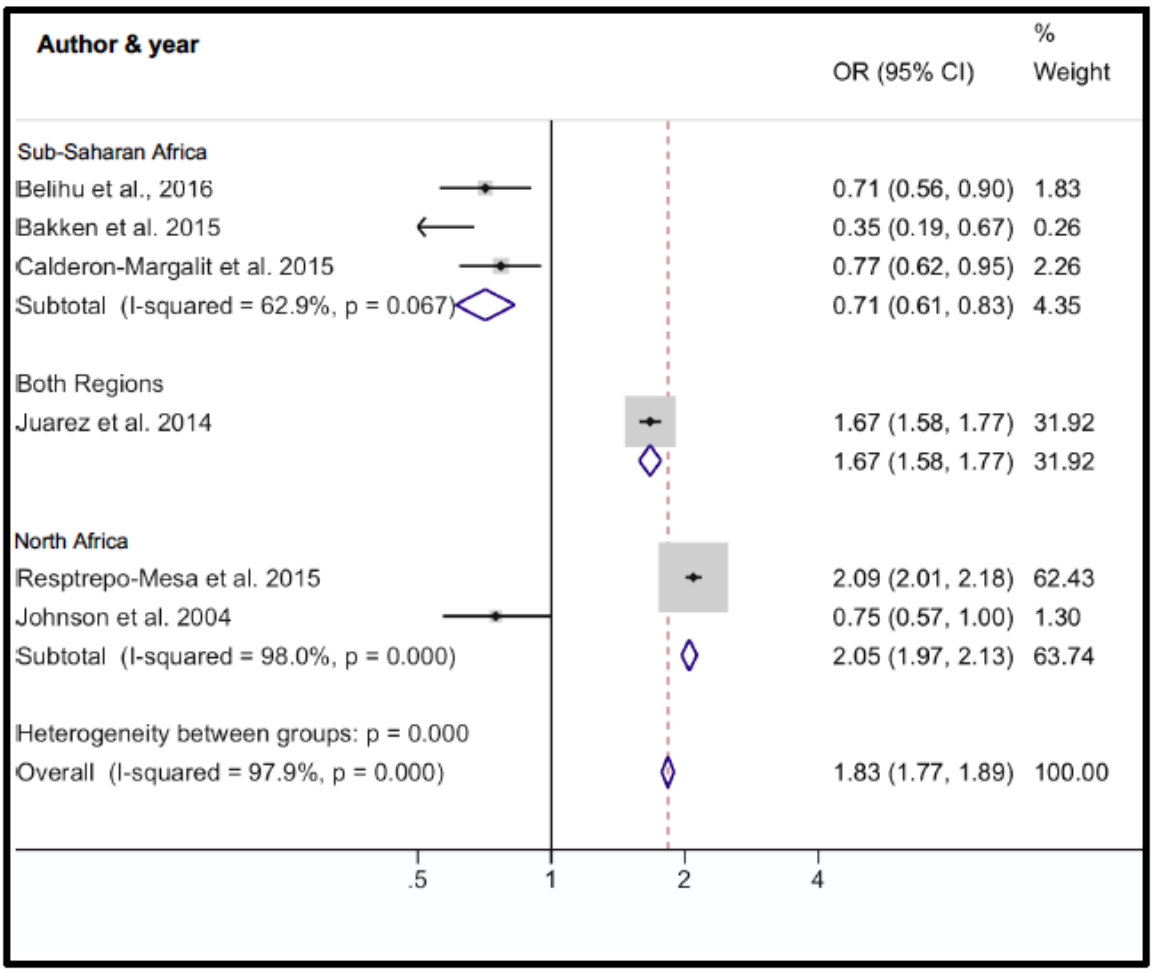
were not robust – results were significant when all studies were included in the analysis; however, when any one of four studies (467, 505, 507, 525) were excluded, the results were no longer significant (Appendix G). There was no evidence of publication bias (Egger's test for small study effects p=0.28) (Appendix G).

Three studies conducted in France (468) and the USA (523, 524) were excluded from the meta-analysis. All three studies included children whose mothers were from SSA. Mean birth weight was higher for African children in one study (mean African=3,307.1g, mean American=3,096.6g; studies did not provide SDs) (524), and lower in the other two – one comparing against French children (African 3,199g; French 3,300g, SD not reported (468)); and another comparing with White American children (African 3,135g; American 3,446g SD not reported (523)). One of these studies (468) also showed that although children from SSA were significantly smaller at birth compared to French children, the weight difference was no longer significant at one month; and at five months of age, African children had higher weights.

5.6.4. Odds of macrosomia in African children compared to non-African children

Six studies were pooled into the analysis for macrosomia, including 2,283,548 children (159,052 African and 2,124,496 non-African). Pooled results showed higher odds of macrosomia in African children compared to non-African children (OR 1.83, 95%CI 1.77 to 1.89), and there was substantial heterogeneity (I^2=97.9%, p<0.01) (Figure 22).

Figure 22: Prevalence of macrosomia in African children compared to non-African children, sub-grouped by African mother's region of origin



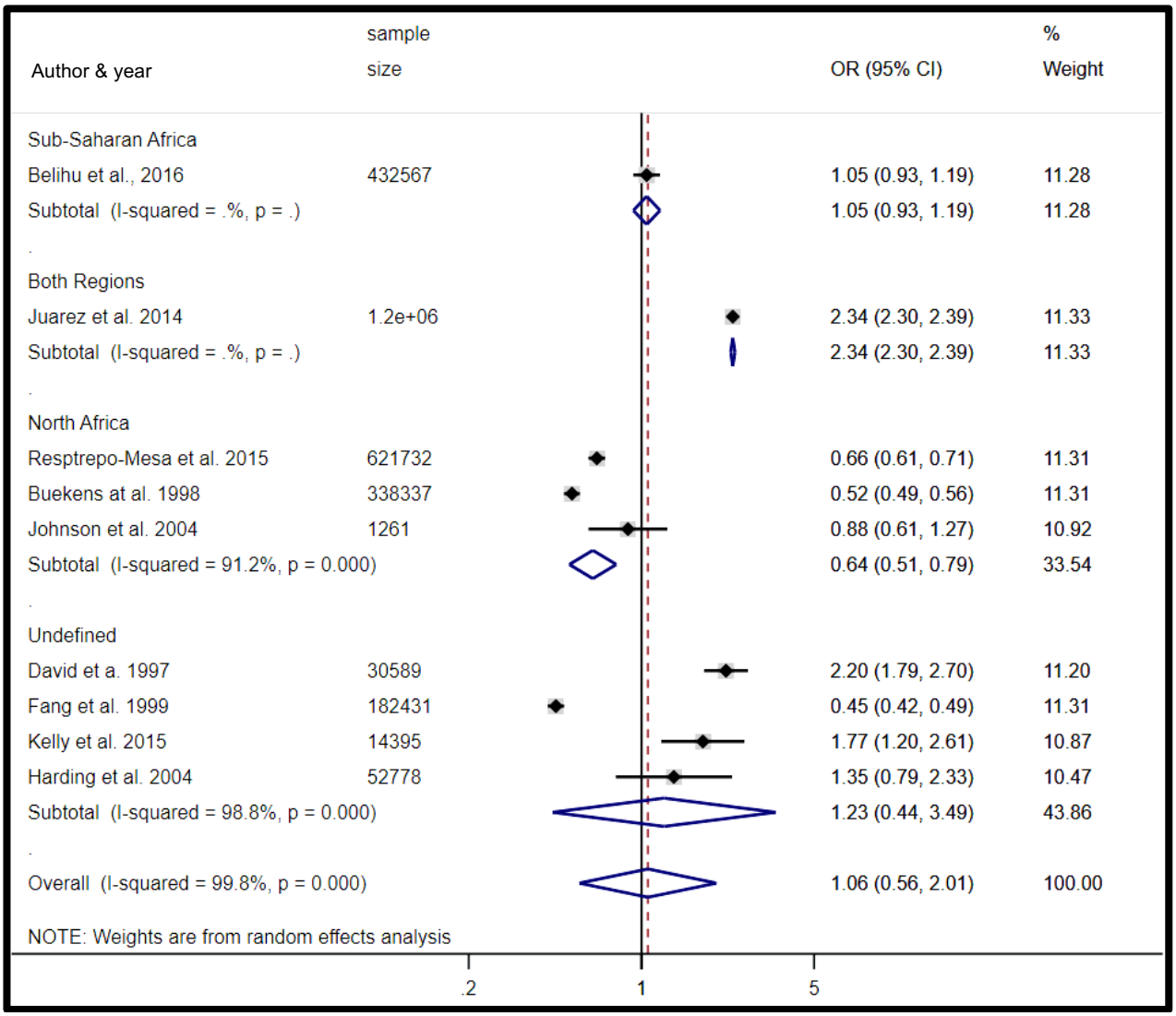
Sub-grouping by African region of origin showed significantly higher odds for children of North African women (OR 2.05, 95%CI 1.97 to 2.13), but lower odds for children whose mothers were from SSA (OR 0.71, 95%CI 0.61 to 0.83) (Appendix G). Heterogeneity was no longer significant for SSA (I^2=62.9%, p=0.07), but still significant for North Africa (I^2=98.0%, p<0.05). Meta regression showed that sample size was significantly contributing to heterogeneity (p=0.04), but not maternal age, study year, study quality or host country (Appendix G). It was not possible to test for the influence of maternal BMI, mother's duration of residence in the HIC and sex of the child as only a few studies provided this data. Results were robust for macrosomia (Appendix G) and there was no evidence of publication bias (Egger's test of small study effects p=0.34).

5.6.5. Odds of low birthweight in African children compared to non-African children

Nine studies reporting on LBW (490, 507, 516, 517, 520, 521, 523, 524, 526) were pooled into a meta-analysis. The analysis included 2,812,492 children (141,567 African and 2,670,925 non-African). There was no significant difference in odds of LBW for African children compared to children of non-African women (OR 1.06 95%CI 0.56 to 2.02) (Figure 23). Heterogeneity across studies was significantly high (I^2 = 99.8%, p<0.01). Stratifying by maternal region of origin did not reduce heterogeneity, and results remained non-significant for North Africa and for studies that did not specify maternal region of origin (Figure 23). There was only one study for SSA (521) which showed no significant difference in LBW between African and non-African children (OR 1.05, 95%CI 0.93 to 1.19); and one study reporting on both African regions (516) with LBW being significantly higher for African children (OR 2.34, 95% CI 2.30 to 2.39; Figure 23).

Meta regression analyses showed that maternal age, sample size, study year, study quality and host country did not contribute to heterogeneity (Appendix G). There was insufficient data to test for maternal BMI, mother's duration of residence in the HIC and sex of the child. Sensitivity analyses showed that the results were robust for LBW (Appendix G). There was no evidence of publication bias (Egger's test for small study effects p=0.11) (Appendix G).

Figure 23: Low birthweight in African children compared to non-African children



Footnote: Undefined – studies did not define the African children's region of origin

5.6.6. Maternal characteristics and influence on child weight outcomes

There was insufficient data to test for the influence of maternal characteristics on children's weight status, except for maternal region of origin as shown in the meta-analyses. No studies reported on associations between maternal characteristics and childhood overweight/obesity. Six studies described the influence of maternal characteristics on mean birthweight and LBW, with inconsistent results (Appendix H). Four of the six studies (515- 517, 521) included in the meta-analysis for macrosomia also reported adjusted ORs, and these were pooled into a

separate meta-analysis. In individual studies, adjusting for maternal age, parity, maternal education and marital status slightly reduced the odds of macrosomia in children of African women in the individual studies. However, the pooled odds of macrosomia remained significantly higher for children of African women compared to children of non- African women (OR 1.92, 95 % CI 1.84 to 2.01) (Appendix H).

In the absence of data on associations between maternal characteristics and child weight, I made comparisons between the characteristics of African and non-African mothers, to give an idea on any maternal factors that may potentially be contributing to the children's risk of overweight and obesity (Appendix H). African mothers were younger than non-African mothers in 11 studies (468, 479, 483, 505, 509, 513, 516, 517, 526, 527, 531), older in seven studies (467, 490, 506, 520, 522, 523, 525) and of similar age in two studies (510, 524). Studies that provided data on maternal weight status, parity, SES, smoking and alcohol during pregnancy reported that African mothers had higher mean BMI or prevalence of overweight/obesity (467, 473, 479, 483, 490, 506, 509-511, 513, 526), higher parity (467, 468, 490, 505, 506, 509, 513, 515, 517, 521-523), lower SES (490, 522, 524) and a lower prevalence of smoking (467, 490, 505, 509, 513, 515, 524-526) and alcohol consumption during pregnancy (490, 513, 524, 525). African mothers also had lower levels of education in 12 out of 16 studies reporting this factor (467, 473, 479, 483, 490, 505, 509, 511, 513, 516, 526, 531), and were more likely to be married in 10 out of 14 studies reporting marital status (467, 505, 507, 513, 516, 517, 521, 524-526). Only one study (515) reported on the African women's duration of residence in the host country (median=6 years).

These maternal characteristics show that African mothers had higher mean BMIs compared to non-African mothers, and high maternal BMI is an independent risk factor for both fetal macrosomia (171), and childhood overweight and obesity (4). African mothers also had higher parity, lower levels of education and lower SES, which are all shown to be associated with increased risks of child overweight and obesity (532-535).

I further explored to see whether the differences in maternal characteristics had any potential influence on the reported child weight outcomes. However, maternal characteristics did not appear to be driving the results on child weight. For example, out of nine studies on birthweight reporting maternal age, African women were older than non-African women in five of these studies and younger in four. There was no difference in birthweight patterns between studies with African women being younger or older. Similarly, five of the six studies on macrosomia reported maternal ages, and African women were younger than non-African women in all five. Two of the five studies found significantly higher odds of macrosomia compared to non-African children, while the other three found no significant difference. Based on these observations and the fact that African migrant women had higher mean BMI and a higher prevalence of overweight/obesity in all the studies, maternal ethnicity and maternal weight status may be playing a bigger role on the children's weight outcomes than other factors.

5.7. CHAPTER SUMMARY

This chapter has shown that African migrant women and children have a high risk of overweight and obesity and are vulnerable groups for unhealthy weight status. This also means, in line with current evidence on the implications of overweight and obesity, that this puts them at risk of further health complications and poor perinatal outcomes (13, 97). Identifying high risk groups for overweight and obesity, as has been done in these reviews, is an important step towards addressing factors that may be contributing to inequalities in weight status across population groups. Tables 9 and 10 below summarise the results on all maternal and child weight outcomes from this review, showing outcomes with significantly higher risks for African migrant women and children (in bold) and also areas where there was limited data.

Table 9: Summary results on maternal weight

	Mean BMI WMD (95% CI)	Overweight OR (95% CI)	Obesity OR (95% CI)	Overweight/obesity OR (95% CI)
All women	**1.95 Kg/m^2 (1.16 - 2.75)***	**2.45 (1.65-3.63)***	**2.70 (1.49 - 4.86)***	**2.09 (1.41 - 3.12)***
Pregnant women	**2.02 Kg/m^2 (0.98 – 3.05)***	**2.45 (1.25 - 4.79)***	1.98 (0.69 – 1.66)	1.89 (0.98 - 3.65)
Non-pregnant women	**1.87 Kg/m^2 (0.60 - 3.14)***	**2.52 (1.01 - 6.32)***	3.47 (0.89 - 13.47)	**2.28 (1.00 - 5.23)***
North Africa	**2.50 Kg/m^2 (1.38 - 3.62)***	**4.73 (1.35 – 16.61)***	**5.54 (4.05 - 7.58)***	**4.41 (2.55 – 7.62)***
SSA	Insufficient data	Insufficient data	Insufficient data	0.86 (0.50 - 1.47)

Footnote: *significantly higher outcome in African women compared to non-African women; OR – odds ratio; WMD – weighted mean difference; CI – confidence interval; SSA – sub-Saharan Africa

Table 10: Summary results on child weight

	Overweight	Obesity	Overweight /obesity	Mean Birthweight	Macrosomia	Low Birthweight
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**	**WMD (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
All children	**1.50 (1.00 – 2.24)***	**2.28 (1.37 - 3.78)***	**2.08 (1.40 - 3.11)***	**48.71g, (4.19g - 93.24g)***	**1.83 (1.77 - 1.89)***	1.06 (0.56 - 2.02)
North Africa	1.85 (0.95 – 3.58)	**2.88 (1.97 – 4.21)***	**2.19 (1.62 – 2.97)***	**108.67 (71.46 – 145.89)***	**2.05 (1.97 – 2.13)***	0.64 (0.51 – 0.79)
SSA	Insufficient data	Insufficient data	Insufficient data	5.40 (-29.46 – 40.26)	0.61 (1.61 – 0.83)	Insufficient data

Footnote: *significantly higher outcome in African children compared to non-African children; OR – odds ratio; WMD – weighted mean difference; CI – confidence interval; SSA – sub-Saharan Africa

The findings of these reviews are useful for supporting the design of population-level and individual-level interventions which aim to prevent overweight and obesity. While recent trends suggest a plateauing or decline in prevalence of childhood overweight and obesity in HICs, there is also evidence of widening socioeconomic inequalities in HIC populations. In a 2016 review analysing childhood obesity trends in HICs (357), the prevalence appeared to be increasing among children from low socioeconomic backgrounds, while there was either 'no change or a decrease' in prevalence among children from higher socioeconomic backgrounds.

Migrant families in HICs are more likely to live in deprived areas or in low-income households (72, 536), and this suggests a disadvantage for their children which may contribute to them having a higher risk of developing overweight and obesity. Addressing ethnic differences in weight status and associated factors will be useful to not only level off but reverse the trend of childhood obesity in HICs.

Many data gaps were identified throughout this review, such as associations between maternal characteristics and child weight. Though there was some evidence on the influence of weight-related behaviours, migration-related factors, sociodemographic factors and weight perceptions on African migrant women's BMI and weight status, the evidence was limited. Future research would be an opportunity to further explore these factors and how they influence the risks of overweight and obesity in this population.

The next chapter of this thesis will be looking at African migrant women's weight-related behaviours; specifically diet and PA, which were among the factors shown in this review to be associated with increased BMI and prevalence of overweight and obesity.

CHAPTER 6: WEIGHT-RELATED BEHAVIOURS OF AFRICAN MIGRANT WOMEN LIVING IN HIGH-INCOME COUNTRIES AND THEIR DETERMINANTS

6.1. CHAPTER INTRODUCTION

This chapter presents my findings on African migrant women's dietary and PA behaviours and their determinants. These findings were published in the journal Nutrients in 2018 (1) (Appendix I). However, this chapter includes findings from three additional studies that were identified after the searches were updated (469, 476, 492).

6.2. DESCRIPTION OF STUDIES INCLUDED IN THIS REVIEW

The search strategy identified a total of 5183 citations. After excluding duplicates and screening titles, abstracts and full-texts against inclusion criteria, 17 studies met the study's inclusion criteria (Figure 24 and Table 11). There were 12 quantitative studies (407, 470, 474-476, 478, 492, 493, 537-540), four qualitative studies (276, 418, 426, 541) and one mixed methods study (469). Four of the studies (470, 475, 539, 542) included pregnant women. Twelve studies were conducted in European countries (two each in Italy (474, 475), Spain (478, 540), Norway (426, 476) and France (469, 539); and one each in England (537), Ireland (470), the Netherlands (418) and Sweden (541)); three studies were conducted in Australia (407, 492, 538), one in Canada (542) and one in Israel (493). Studies included women from both North Africa and SSA, originating from 15 African countries (Algeria, Benin, Cameroon, Cape-Verde, Egypt, Eritrea, Ethiopia, Ghana, Ivory Coast, Mali, Morocco, Niger, Nigeria, Senegal and Somalia). The number of women in each study ranged from seven to 80 in the qualitative studies and from 22 to 924 in the quantitative studies, giving a total of 4,639 women, of which 1,251 were pregnant. Twelve studies reported how long the women had lived in HICs, which

ranged between less than one ear to over 15 years. Quality assessment of the studies found 10 good quality studies and seven of fair quality. No included studies were deemed to be of poor quality.

Figure 24: PRISMA flow chart showing selection of studies for inclusion in systematic review on weight-related behaviours and determinants

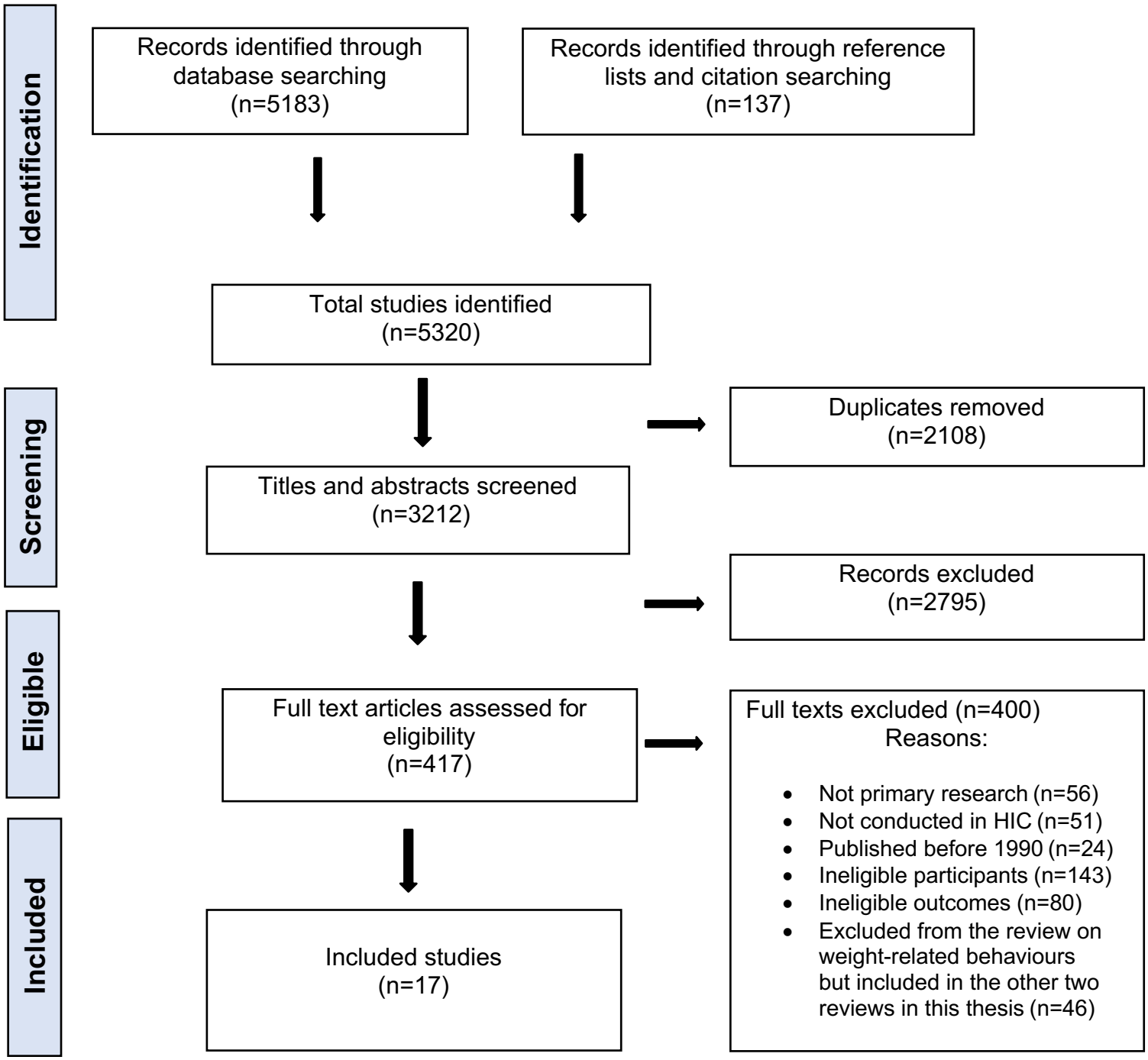


Table 11: Characteristics of studies included in review of weight-related behaviours and determinants

Author, year (Reference number)	Study country	Study design	Participants' regions (countries) of origin and sample size	Participant ages (years) Mean (SD) or range	Duration of residence in HIC (years)	Study quality
Ahmed *et al.* 2018 (476)	Norway	Quantitative	SSA (Somalia), n=1066	37.7 (10.1)	NR	Good
Casali *et al.* 2015 (475)*	Italy	Quantitative	NA & SSA (countries not specified), n=66	31.8 (7.3)	NR	Fair
Cohen *et al.* 2017 (469)	France	Mixed methods	SSA (Cameroon), n=28	18-30	NR	Good
Dassanayake *et al.* 2011 (407)	Australia	Quantitative	NA (countries not specified), n=122	NR	NR	Good
Delisle *et al.* 2009 (540)	Spain	Quantitative	SSA (countries not specified), n=130	<30 - 45	<6 to >11	Good
Dominguez *et al.* 2008 (474)	Italy	Quantitative	SSA (Ivory Coast, Ghana, Nigeria, Mali, Benin), n=23	29.9 (8.3)	NR	Good
Garnweidner *et al.* 2012 (426)	Norway	Qualitative	NA (Algeria, Egypt, Morocco); SSA (Somalia), n=7	25-46	<10	Good
Gil *et al.* 2005 (478)	Spain	Quantitative	SSA (countries not specified), n=130	8.2 (6.9)	8.2	Fair
Lindsay *et al.* 2014 (470)*	Ireland	Quantitative	SSA (Nigeria), n=52	7.5 (3.2)	<5 to >10	Fair
Nicolaou *et al.* 2012 (418)	Netherlands	Qualitative	NA (Morocco), n=22	27-46	<10 - ³21	Good
Persson *et al.* 2014 (541)	Sweden	Qualitative	SSA (Somalia), n=26	11.56, no SD provided	NR	Good
Quintanilha *et al.* 2016 (542)*	Canada	Qualitative	SSA (Eritrea, Ethiopia, Somalia), n=80	NR	<1 to 3	Fair
Regev *et al.* 2012 (493)	Israel	Quantitative	SSA (Ethiopia), n=53	32 (6)	Mean (SD), 13.8 (5.8)	Good
Renzaho 2006 (543)	Australia	Quantitative	SSA (countries not specified), n=111	NR	NR	Good
Roville-Sausse *et al.*1998 (539)*	France	Quantitative	SSA (Senegal, Mali, Niger), n=129	18-41	<10	Fair
Saleh *et al.* 2002 (492)	Australia	Quantitative	SSA (Ghana), n=35	NR	Mean (SD) 7.8 (5.1)	Fair

Author, year (Reference number)	Study country	Study design	Participants' regions (countries) of origin and sample size	Participant ages (years) Mean (SD) or range	Duration of residence in HIC (years)	Study quality
Smith *et al.* 2011 (537)	England	Quantitative	R Region and countries not specified, n=587	16-34	NR	Fair

Footnote: SSA – sub-Saharan Africa; NA – North Africa; NR – not reported

6.3. RESULTS

The findings from this review are sub-grouped into three sections, which are: African migrant women's dietary behaviours, African migrant women's PA behaviours, and determinants of both dietary and PA behaviours. Eleven studies reported on dietary behaviours (426, 469, 470, 475, 478, 492, 493, 537, 539, 540, 543), eight reported on PA behaviours (407, 469, 474, 475, 478, 493, 537, 540) and nine reported on determinants (418, 426, 469, 493, 541-543).

6.3.1. Dietary behaviours of African migrant women

Studies reporting on African migrant women's dietary behaviours are summarized in Table 12. These studies described the women's dietary patterns, their food practices (including shopping, cooking and eating behaviours) and their nutrient intakes.

Table 12: Studies reporting on dietary behaviours and determinants of dietary behaviours

Author, year (reference)	Host Country	African countries of origin and sample size	Dietary outcomes measured	Data collection methods
Casali *et al.* 2015 (475)*	Italy	North Africa and SSA (countries not specified), n=66	Dietary patterns	Interviews, Questionnaires
Cohen *et al.* 2017 (469)	France	SSA (Cameroon), n=28	Dietary patterns and food practices, determinants of dietary behaviours	Interviews and survey
Delisle *et al.* 2009 (540)	Spain	West Africa (countries not specified), n=130	Dietary patterns	Interviews, Food frequency questionnaires
Garnweidner *et al*. 2012 (426)	Norway	North Africa (Algeria, Egypt, Morocco); North East Africa (Somalia), n=7	Dietary patterns, determinants of dietary behaviours	Interviews
Gil *et al.* 2005 (478)	Spain	West Africa (countries not specified), n=130	Dietary patterns, nutrient intakes	Interviews, Food frequency questionnaires
Lindsay *et al.* 2014 (470) *	Ireland	West Africa (Nigeria), n=52	Dietary patterns, nutrient intakes	Interviews, 24-hour recall
Nicolaou *et al.* 2012 (418)	Netherlands	North Africa (Morocco), n=22	Determinants of dietary behaviours	Focus group discussions
Quintanilha *et al.* 2016 (542) *	Canada	North East Africa (Eritrea, Ethiopia, Oromo, Somalia), n=80	Determinants of dietary behaviours	Focus group discussions
Regev *et al.* 2012 (493)	Israel	North East Africa (Ethiopia), n=53	Dietary patterns, determinants of dietary behaviours	Interviews, 24-hour recall

Renzaho 2006 (543)	Australia	SSA (countries not specified), n=111	Dietary patterns and food practices, determinants of dietary behaviours	Interviews
Roville-Sausse 1998 (539)*	France	SSA (Senegal, Mali, Niger), n=129	Dietary patterns and food practices, determinants of dietary behaviours	Not reported
Saleh *et al.* 2002 (492)	Australia	SSA (Ghana), n=35	Dietary patterns and food practices	Food frequency questionnaires
Smith *et al.* 2011 (537)	UK	Region or countries not specified, n=587	Dietary patterns	Survey, Questionnaires

Footnote: SSA – Sub Saharan African, PA – PA, *Study includes pregnant women

6.3.1.1. Dietary patterns and food practices of African migrant women

Studies on dietary patterns explored whether, and to what extent the women's traditional or African dietary patterns had changed after having migrated to the host countries. The women were generally shown to preserve their traditional dietary patterns, although some did so more strictly than others. Women who adhered strictly to their traditional dietary patterns consumed African food more regularly, which predominantly consisted of tubers (e.g. yam, cocoyam and cassava), rice, other grains, African vegetables, spicy stews, heavily-seasoned soups, fish and meat (426, 469, 470, 539). Snacking was uncommon and food items adopted from the host country, if at all, were usually consumed at breakfast (e.g. toast, sausages, bacon and sugar-sweetened cereals) (426, 470). A participant stated in one of the studies that 'there is not even a concept to express "snack" in our tradition, we only ate three times a day' (469), demonstrating how uncommon snacking was before migration.

Preserving their traditional food cultures was so important that the women developed 'coping strategies' to enable them replicate their traditional dishes, especially as local food items or ingredients were usually either unavailable, in short supply or very expensive in the host countries (492, 493, 543). Examples of these hard-to-get food items included African vegetables (e.g. sweet potato leaves, cassava leaves, amaranth and pumpkin leaves), tropical root crops, black-eyed beans, maize flour, camel milk, smoked fish and cocoyam products (492, 493, 543). Women resorted to substituting these local food items or ingredients with similar items they were able to find in the host country (492, 493, 543).

On the other hand, women who adhered less strictly to their traditional dietary patterns consumed African food less often, snacked more frequently and their diets were high in carbohydrates, fats, processed meats and sugar-sweetened beverages; as opposed to their traditional diets which contained more protein, less fats and less sugar (426, 478, 493, 537, 540). Examples of adopted food items included pizza, cheese, breakfast cereals, battered

fish, sandwiches, chilled desserts, pastries, candies and soft drinks. There was also a common theme where women reported a reduced consumption of fish after migration and an increased intake of fruits (469, 475, 492, 537, 540, 543). In one of these studies, participants revealed that back home, ‘fruits are for children’, and so not commonly eaten by adults (469).

Although African migrant women were generally shown to have adopted some elements of the host country’s food culture, they showed preference for their traditional seasoning and cooking methods over those used in the host countries (418, 426, 543). HIC foods were described as ‘tasteless’, usually due to a lack of salt or spices, and women reported adding these to HIC foods, or preparing the food ‘in their own way’ to make them more palatable (426, 493, 543). Newly adopted eating practices which were uncommon before migration were snacking between meals, taking breakfast and eating out of their houses and not eating together as a family due to the nature of their work lives in HICs (418, 493, 543).

The above findings are concurrent with the literature on migrants’ dietary behaviours in HICs, which usually show an increased consumption of food with high salt, high sugar and high fat content, increased snacking and increased out-of-home eating frequency (70). Note that these are all associated with an increased risk of overweight and obesity (13, 70, 97), and therefore, cause for concern among women of child-bearing age.

6.3.1.2. Nutrient intakes of African migrant women

Studies reporting on nutrient intakes assessed energy, macronutrient and micronutrient intakes of African migrant women (470, 478, 493, 540). I also compared these values with WHO-recommended intakes for women of child-bearing age (149, 373). Results were presented as mean (SD) and percentage of total energy (%TE) derived from nutrients. Two studies (470, 493) also reported on nutrient supplement usage and three reported on nutrient inadequacies (470, 493, 540).

(a) Energy and macronutrient intakes

Table 13 shows the reported mean intakes of energy and macronutrients in pregnant and non-pregnant women of childbearing age and a comparison with WHO-recommended intakes. Five macronutrients were analysed, which were: carbohydrate, protein, total fat, cholesterol and dietary fibre. Only one study in Ireland (470) reported intakes in pregnant women, which included total energy, dietary fibre and %TE from carbohydrate, protein and fat (470). Compared to WHO reference ranges, mean intakes of total energy and dietary fibre were low, while %TE were higher for protein and fat (470). For non-pregnant women, carbohydrate intakes were higher compared to WHO recommendations (478, 493), while intakes of dietary fibre were lower. Results for protein, fat and cholesterol were inconsistent. Only one study reported %TE in non-pregnant women of childbearing age and all values were within the WHO reference ranges.

Table 13: Daily energy and macronutrient intake; and %TE in African migrant women

Energy and Macronutrient	Reported intakes				WHO recommended intakes		
	Mean (SD) - pregnant women (470)	**Mean (SD) – women of non-pregnant women** (478, 493)	**%TE pregnant women** (470)	**%TE non-pregnant women** (493)	**Mean intake in pregnancy**	**Mean intake in women of childbearing age**	**%TE[2] (both pregnant women and women of childbearing age)**
Energy (Kcal)[2]	2393 (784)	NR	51.9	n/a	2750	n/a	n/a
Carbohydrate (g)	NR	163.2 (63.6) 273.6 (67.0)	19.4	65	n/a	130	55-75
Protein (g)	NR	33.8 (16.1) 107.2 (24.6)	33.3	13.5	n/a	46	10-15
Total fat (g)	NR	25.3 (10.2) 85.7 (22.7)	447.4	22.8	n/a	<70	15-30
Cholesterol (g)	NR	66 447.4	NR	66	n/a	<300mg/day	<300mg/day
Dietary fibre (g)	20.0 (9.8)	8.6 (4.4) 21.3 (6.0)	NR	NR	28	25	n/a

Foot note: NR – Not reported, n/a – not applicable

(b) Micronutrient intakes

A total of 15 micronutrients were reported in three studies (470, 478, 493), one of which included pregnant women (470) (Table 14). Compared to WHO recommendations, both pregnant and non-pregnant women had higher intakes of sodium, vitamin A and vitamin C (470, 478, 493), and lower intakes of iron and folate (478, 493). Pregnant women also had higher intakes of vitamin B12, iodine and selenium, and lower intakes of calcium (470). Meanwhile, non-pregnant women had higher intakes of vitamin E, magnesium and phosphorus and lower intakes of vitamin B12 (478, 493). Results for calcium and zinc in non-pregnant women were inconsistent; intakes were higher in one study (478) and lower in the other (493). Adequate intakes were only reported for two micronutrients; vitamin D in pregnant women (470) and folic acid in non-pregnant women (478).

Micronutrient	**Reported intakes for pregnant women Mean (SD)** (470)	**WHO recommended intakes in pregnancy** (373)	**Reported intakes for non-pregnant women Mean (SD)**	**WHO recommended intakes in women for women of childbearing age** (373)
Calcium (mg)	726.6 (425.8)	1500-2000	1074 (344) (478) 277 (152) (493)	1000
Folate (mg)	308.4 (141.9)	600	129 (58) (493)	400
Folic acid (g)	NR	NR	399.5 (109) (478)	400
Iodine (mg)	247.6 (163.0)	200	NR	n/a
Iron (mg)	14.0 (5.8)	27	18.2 (3.9)(478) 12.8 (6.6)(493)	24
Magnesium (mg)	NR	NR	228 (51) (493)	220
Phosphorus (mg)	NR	NR	635 (15) (493)	580
Selenium (mg)	77.9 (37.0)	30	NR	n/a
Sodium (mg)	4646 (2130)	<2000	4266 (1250) (478)	<2000
Vitamin A (mg)	1448 (1886)	800	878.2 (944) (478)	500
Vitamin B12 (mg)	6.8 (5.2)	2.6	0.75 (0.66) (493)	2.4
Vitamin C (mg)	224.6 (130.4)	55	175.3 (92.3) (478) 70 (51) (493)	45
Vitamin D (mg)	5.1 (6.5)	5	NR	n/a
Vitamin E (mg)	NR	n/a	14.0 (4.1) (478)	7.5
Zinc (mg)	NR	NR	13.0 (3.1) (478) 4.1 (0.7) (493)	4.9 – 9.8

Footnote: NR – Not reported; n/a – not applicable; SD–standard deviation

(c) Nutrient supplement usage in African migrant women

Two studies, one including pregnant women (470) and the other including non-pregnant women (493), reported whether they took any nutritional supplements. Most of the pregnant women took folic acid during pregnancy, and some took iron, vitamin D and multivitamin/mineral supplements (470). None of the non-pregnant women were reported to be taking any dietary supplements (493).

The above findings suggest that there may be micronutrient deficiencies in African migrant women, as their diets were found to be lacking in iron, folate, and calcium. Micronutrient deficiencies continue to be of public health concern worldwide, especially among women of child-bearing age (544, 545). As stated in chapter 1 section 1.3, it is important for women of childbearing age to maintain good nutrition throughout their reproductive years, to ensure successful and healthy pregnancy outcomes. While the problem of micronutrient deficiencies may not be particular to African migrant women, statistics from HICs show that pregnant women of African origin are particularly at risk of pregnancy complications and adverse birth outcomes compared to women from other ethnic groups (546-548). Thus, the problem of micronutrient deficiencies, in addition to poor maternal weight status (as seen in Chapter 6) which itself has its own risk of pregnancy complications, puts these women at a further disadvantage.

6.3.2. PA behaviours of African migrant women

PA behaviours were assessed and defined differently, as shown in Table 15. Six studies reported on the women's PA frequency in HICs (407, 474, 478, 493, 537, 540) and three also compared the women's PA levels before and after migration (469, 475, 493). All findings were based on self-reported assessments of PA.

Findings on women's PA frequency were inconsistent: while two studies conducted in France reported that over 60% of the African women did not practice exercise regularly (478, 540), a study conducted in Italy reported that most of the women in their study (87.5%) exercised at least 3 times a week (474). Compared to the host population in HICs, African migrant women were shown to be more inactive in two studies (407, 537). A UK study showed that African women in England were significantly more likely to be physically inactive compared to White women (OR physical inactivity 2.16, 95% CI 1.71-2.75). In this study, 40.7% of the African women had done exercise 3 times or less in the 4 weeks prior to the study, compared to 26.7% of women from the UK (537). Another study which compared the prevalence of physical inactivity in Australia reported similar levels in North African women (75%) and women from Australia (72%); however, women from SSA were less inactive (60.47%) (407).

Studies comparing pre- and post-migration showed that the women's PA levels had reduced after migration. In one of the studies (475), almost half (49.5%) of the women did sports-related activities regularly in their countries of origin, but a majority of the women (87.5%) stopped these activities after migrating to Italy. The women were also noted to have a significant reduction in the mean time spent on activities like walking and cycling (160 minutes per day pre-migration and 110 minutes per day after migration) (475). Another study described the women as having 'high energy expenditure' in their country of origin, but 'minimal PA' after migrating to Israel (493). Most of the women (72%) did not exercise on a daily basis, and almost half of them (49%) reported walking for less than 30 minutes per day (493). These findings are consistent with the literature on migrant women's PA behaviours, which generally

show reduced PA levels after moving to a HIC (244, 363, 370, 406-409). However, quotes extracted from a study conducted in France (469) had some contrasting findings, and were suggestive of women becoming more active after migration. About her country of origin, a participant stated that 'we are too sedentary in our country…', and that 'we do not practice sports' (469). Meanwhile, another participant described making efforts to be active after migrating to France:

> 'When I can, I walk. I would not take my car to buy bread as some people do. Sometimes, I go to the same post office five times a day by foot' (469).

These efforts were aimed at trying to avoid the damage of a sedentary lifestyle (469). These findings indicate that the influence of acculturation is not always the same for all migrants, as the effects may be more positive for some. Studies on PA behaviours of migrants have mostly focused on identifying barriers for PA, especially relating to social and environmental factors. This is understandable, given current trends which show that most migrants become less active after migration. However, it would also be useful to identify factors that influence other migrants – like the ones described above – to become more active.

Table 15: Studies reporting on PA and determinants of PA

Author	Host Country	Population countries of origin	PA outcome measured (including definitions of PA)
Dominguez *et al.* 2008 (474)	Italy	Sub-Saharan Africa (Ivory Coast, Ghana, Nigeria, Mali, Benin), n=23	Frequency of PA per week. PA defined as moderate or strenuous exercise sufficient to induce sweating including any sport, brisk walking or doing housework at least once a week for >30 minutes.
Casali *et al.* 2015 (475)[1]	Italy	North Africa and SSA (countries not specified), n=66	PA behaviours before and after migration. PA described as sport activities
Cohen *et al.* 2017 (469)	France	SSA (Cameroon), n=28	PA behaviours before and after migration; determinants of PA behaviours. PA defined as average level of intense and moderate daily PA (in hours)
Dassanayake *et al.* 2011 (407)	Australia	North Africa, Other Africa (countries not specified), n=122	Frequency and amount of time spent on PA relating to sport and fitness in the past 2 weeks
Delisle *et al.* 2009 (540)	Spain	West Africa (countries not specified), n=130	Frequency of exercise (activities not defined)
Gil *et al.* 2005 (478)	Spain	West Africa (countries not specified), n=130	Regular practice of exercise (activities not defined)
Nicolaou *et al.* 2012 (418)	Netherlands	North Africa (Morocco), n=22	Determinants of PA behaviours
Persson *et al.* 2014 (541)	Sweden	East Africa (Somalia), n=26	Determinants of PA behaviours
Quintanilha *et al.* 2016 (542)[1]	Canada	North East Africa (Eritrea, Ethiopia, Oromo, Somalia), n=80	Determinants of PA behaviours
Regev *et al.* 2012 (493)	Israel	North East Africa (Ethiopia), n=53	Daily exercise, PA at work, time spent walking per day
Smith *et al.* 2011 (537)	UK	Region or countries not specified, n=587	Moderate or vigorous PA of at least 30 minutes in the last 4 weeks

Footnote: [1]Study includes pregnant women

6.3.3. Determinants of dietary and PA behaviours of African migrant women

Seven studies provided data on the factors influencing the dietary behaviours of African migrant women (418, 426, 469, 493, 542, 543) (539), while five reported on determinants of the women's PA behaviours (469) (418, 493, 541, 542). Three studies included pregnant women (475, 539, 542). The findings are presented following the a-priori themes presented in Chapter 4 Table 4. Data were available for five of the six a-priori themes (sociodemographic factors, migration-related factors, culture and religion, pregnancy-related factors, and knowledge and perceptions on diet and PA); and also one data-driven emergent theme (competing priorities). There was limited data on sociodemographic factors, while the bulk of evidence addressed migration-related factors, especially relating to the post-migration environment. There was also limited data on the determinants of weight-related behaviours in pregnant women. No data were available for one a-priori theme (other health-related factors).

(a) Sociodemographic factors

There was limited data on the influence of sociodemographic factors on women's behaviours. One study (493) found a negative correlation between maternal age and the consumption of dairy products, fats, simple sugars and soft drinks ($p<0.001$). Dietary change after migration was reported as being as a result of an improvement in migrants' financial situation (418, 475), such that 'they can afford to eat fast food' (418). This statement implies that being able to eat fast food was seen as something positive, and also linked to increased wealth. Another study reported income as a barrier to PA, where women cited the lack of financial resources to enrol in gyms or fitness classes that suited their needs (542). Note that the women's interpretation of PA in this study referred to organised activities like going to the gym, cycling or attending fitness classes, as opposed to habitual PA like walking and household chores. There was no data on the women's level of education or other measures of SES additionally to income.

(b) Migration-related factors

One study found that increased duration of residence in HICs was significantly associated with a more frequent consumption of high calorie foods, especially among recent migrants (469). Five studies (418, 426, 493, 542, 543) also described how the new environments that African women lived in after migrating to HICs influenced their dietary behaviours.

(i) Food environment:

The food environment in HICs was reported both as a barrier and a facilitator to healthy eating. The constant availability of food was a facilitator, as this brought a level of food security in the women's households compared with their countries of origin where they sometimes experienced food scarcity (543). However, the abundance of cheap and unhealthy convenience foods was a barrier to healthy eating, as this influenced women to eat out more, cook less, and snack more often (418, 426, 542, 543).

Healthy food was described as costly, a factor that prevented women from eating what they believed they should (542). In a Canadian study, pregnant women expressed a feeling that the cost of healthy eating was usually not taken into consideration by health care providers:

> 'Here, in Canada, even doctors and nurses don't really consider poverty, they just kind of treat everybody the same, you go in, they give you a list of things that you need to do but they don't really consider what it's like living inside and outside our daily lives' (542)

This highlights an important challenge for pregnant women who are especially at risk of adverse health outcomes as a result of poor nutrition. High costs were also mentioned in relation to African food items in HICs, which women identified as a barrier to preserving their African dietary patterns (469).

(ii) Family environment:

African women's food choices were often influenced by the preferences of family members with whom they lived (418, 426). One factor that women identified as contributing to dietary change after migration was the fact that their children often preferred to eat Western foods adopted from the host country, such as pizza and fries (418). The children's desires for these drove the women to serve these foods at mealtimes, hence making it difficult to maintain African dietary patterns in their households (418). Meanwhile, the women's husbands preferred or 'expected' to be served African traditional foods, so they had to cook separate meals for their husbands and children (418, 426).

(iii) Living environment:

African women described the houses where they lived in HICs as relatively small (418), and they had more household appliances which reduced their daily PA related to household chores (418, 541). However, women from North and North East Africa also reported that they were used to living with extended family members who all participated in household chores, whereas this was not the case in HICs. This contributed to increasing their habitual PA levels in HICs, but also limiting the 'spare time' they had to engage in structured exercise (541).

(iv) Work environment:

Living and working in HICs made the women's schedules very busy and also increased the amount of time they spent away from home, which decreased their frequency of cooking at home and increased their frequency of eating snacks and take-away foods (426, 493, 542). One of the studies also noted that none of the women in their sample had jobs that required a high level of PA, so their work environments in HICs tended to promote sedentary activity (493). Family members having different work schedules was seen as contributing to irregular meal times, preventing the women from eating together with their families family as they usually did in their countries of origin (418).

(v) Natural environment:

The weather in HICs contributed to changes in the women's dietary behaviours since organic food and homegrown fruits, vegetables and grains which they preferred and which were more readily available throughout the year in Africa, were not as abundant in HICs, and usually more expensive (542). The cold and wet weather in HICs was also reported to be a barrier to PA, and women reported avoiding participation in any outdoor activities during such weather (418, 541, 542). A participant explained in one of the studies that people are healthier 'back home' than in the HIC because 'there you have the sun, you're busy the whole time and you burn fat. Here the weather is always bad, and we have little opportunity for movement' (418). The weather in HICs is shown here as preventing women from being active, unlike the warm climate in the women's home countries which enabled them to engage in activities like farming and walking to the market (418, 541, 542). The weather also influenced the means of transportation the women used during the winter, as they preferred motorised rather than active transport such as walking. North African women described how they were accustomed to staying indoors and sleeping in on rainy days, and only left the house if they had reason to (e.g. going to work or taking children to/from school) (541).

(vi) Built environment:

Built environments in HICs presented a barrier to PA in that the streets around the women's neighbourhoods usually either lacked sidewalks or had high volumes of traffic (418, 541). The wide availability of transport facilities (e.g. buses and trains) also significantly reduced the amount of time that the women spent walking (418, 541). The women felt that their environments 'back home' were more conducive to being physically active (542), as they usually walked long distances to buy groceries and household supplies (541).

(c) Culture and religion

African women emphasised the importance of culture to their dietary behaviours and traditional food habits (418, 426, 493, 543). The women expressed pride in their African cuisine, highlighting the importance of using traditional spices to enhance taste. Food played a key role in showing hospitality

and African food cultures were always preserved during cultural and religious events (418, 426). Religious rules also played a role on food choices and shopping patterns, especially for Muslim women who did not eat pork or had to determine whether food was 'halal' (adheres to Islamic law) before consumption (418, 426).

Cultural and religious factors also played an important role on women's ability to exercise, especially for women from Muslim backgrounds whose culture did not encourage women to mix with men in public spaces; meanwhile there is a lack of female only centres in HICs (418, 541). Some women also described that their traditional outfits were not suitable for PA and the possibility of people watching while they exercised was an additional barrier to PA (541). Participation in PA relied on the activities meeting their cultural needs, such as having an informal leader from a similar cultural background, being accompanied by other women or being able to dress in their traditional attires (541).

(d) Pregnancy status

Reasons for eating unhealthy foods during pregnancy included tiredness, long work hours, pregnancy stress and a lack of support from family and friends in HICs (542). Pregnant women also reported following their traditional behaviours and restraining from certain food items in order to avoid having a baby that is 'too large' (539).

(e) Knowledge and perceptions on diet and PA

African women described HIC foods as healthier than their traditional meals because they were less dense and contained less oil and sugar (426), whereas their traditional dishes were 'oily, spicy, high in calories and fattening' – all of which they attributed to poor nutrition (418). However, HIC foods were usually not appealing to these women because they were thought to be 'lacking in nutrients' due to the way they were prepared (426). For example, the women in one study believed that boiling vegetables (as was commonly done in the HIC where they were living) made them watery and less nutritious; unlike frying, which they believed helped to preserve nutritional value and maintain

crispiness (426). These perceptions, in addition to the high cultural importance that women placed on their traditional African foods promoted the preservation of African dietary patterns after migration.

African women showed an understanding for the need of PA and acknowledged that it is important to health and well-being (418, 541). However, discussions on PA revealed confusion regarding the distinction between PA associated with daily activities and leisure time PA aimed at enhancing health and fitness. For example, in one study, women understood PA as having to engage in fitness classes, swimming or cycling, all activities that they were not familiar with. Participation in leisure-time or health-related PA was a concept women only became familiar with after migration. For example, women described how PA such as walking was normally incorporated into their daily lives in their countries of origin, so they were not familiar with the concept of walking for health (541). A lack of familiarity was also expressed with some organised physical activities such as cycling or swimming and many had never learned to cycle or swim (418).

(f) Competing priorities

Women listed several other activities which they were involved in daily, outlining that these usually did not leave them enough time to prepare home-made meals as they usually did in their countries of origin. Some of these activities included going to work, attending school, looking after children and managing day-to-day tasks at home (418, 426, 538):

> '…you have to run around, if you have to work, and you have to do house chores you might not get enough sleep. And you might have to cook but you don't want to cook because you are tired' (542).

As such, foods adopted from HICs were frequently cooked because they were considered less time-consuming to prepare and enabled women to serve warm meals on busy days (418, 426, 538). These factors also influenced eating outside the home or ordering food online (542). The same responsibilities competing for African women's time were also cited as barriers to PA (418, 493, 541).

6.4. CHAPTER SUMMARY

This review aimed to synthesize the evidence on dietary and PA behaviours, and determinants of behaviours, among pregnant women and women of childbearing age who have migrated from African countries to live in HICs. Findings on dietary patterns showed that no participants completely changed their traditional dietary practices to those in HICs. Rather, dietary patterns were bicultural, with an overlap between HIC and traditional dietary practices. Examples of adopted 'unhealthy' dietary behaviours included increased snacking frequency, high consumption of processed foods, high intakes of sweets and sweet drinks, less cooking at home and increased out-of-home eating. Similar behaviours have also been observed among other non-African migrant populations in other reviews (229, 549). A few healthy behaviours were also adopted, such as an increased consumption of fruits, taking breakfast more regularly, and for some migrants, becoming more active (particularly engagements in structure activities).

Micronutrient analyses suggest low levels of folate, calcium and iron, and high sodium intakes. Deficiencies in multiple micronutrients are a reflection of poor diets and are associated with pregnancy complications and haematological consequences, which may increase the risk of haemorrhage and death during pregnancy (550). A high sodium intake increases the risk of metabolic disorders and pregnancy complications such as preeclampsia (551). Future intervention research could prioritise improving the diet quality, especially micronutrients, for this population of women.

Dietary behaviours were shaped by several factors, many of which involved the post-migration environment. Factors that facilitated the maintenance of African dietary practices after migration included cultural and religious beliefs, having African community and social networks, the availability of ethnic shops in HICs and participants' perceptions of HIC foods. On the other hand, the likelihood of adopting host-country dietary practices was increased by factors such as the abundance of cheap, unhealthy convenience foods in HICs, busy lifestyles and not having enough time to cook African foods. These findings fit in the model of dietary acculturation proposed by Satia-Abouta *et al.* (552),

which shows that dietary changes are governed by sociodemographic, cultural and environmental factors.

Findings on PA behaviours were inconsistent, although there was a general sense of low levels of PA amongst women who had migrated from African countries. Culture, religion and post-migration environments played the biggest role on women's PA behaviours in the evidence reported. Migrating to HICs was shown to influence a more sedentary lifestyle, especially as their habitual activities relating to house chores and transportation were reduced; unlike back home where these kept them more active.

There was a paucity of data on dietary and PA behaviours in pregnant women. In addition, data were not available for several *a priori* factors which were drawn from the evidence base of determinants of dietary and PA behaviours in other populations. These include sociodemographic factors (maternal age, parity, maternal education, socioeconomic status), migration-related factors (duration of residence, age at time of migration and immigrant status), health status, other health behaviours (smoking, alcohol consumption) and pregnancy-related factors (gestational age or pregnancy specific health conditions such as gestational diabetes). Further studies are required to explore the influence of these factors on women's dietary and PA behaviours. There was also a paucity of data which directly compared migrant and host-country populations. Further research is needed to understand differences and commonalities in factors underlying their dietary and PA behaviours.

This chapter brings the systematic review part of my research to an end. Further critical discussions on the overall findings from these chapters and their implications are presented in Chapter 10. The next three chapters describe the qualitative part of this research, and offers another perspective on some of the findings from chapters 5 and 6.

CHAPTER 7: QUALITATIVE RESEARCH METHODS

7.1. CHAPTER INTRODUCTION

This chapter describes the methods used throughout the qualitative phase of this research. It details the processes followed during the recruitment and selection of study participants, collection of data and data analysis. The chapter ends with a critical reflection of my experiences during the research process and how these may have influenced my decisions or study outcomes.

7.2. STUDY SETTING AND PARTICIPANTS

This study took place in the UK. Participants were African migrant women who had migrated from three countries in Sub-Saharan Africa, which were Nigeria, Ghana and Cameroon. Nigeria and Ghana were selected because these are amongst the largest African migrant populations in the UK (553). Cameroon was selected due to my links and access to this community of migrants in the UK.

7.2.1. Sampling and participant recruitment

Eligible participants included women aged 18–45 years, who had lived in the UK for at least 6 months, and were either currently pregnant or had given birth within the last 3 years. Participants were selected using purposive, convenience and snowball sampling methods. To enhance the representativeness of my study sample, I targeted women from different settings as would appear in the general population – for example, both formal and informal community settings (e.g. through women's places of work, education or social interaction); women of different age groups (all being of child-bearing age); groups for pregnant women and groups for mothers; and migrant support groups to reach women who had lived in the UK for different lengths of time. In this way, my sampling reflected some of the key elements of the population under study.

7.2.2. Purposive sampling

Purposive sampling is a non-random sampling technique whereby the researcher recruits participants based on particular characteristics of a population of interest (554). As African migrants are widespread throughout the UK, this method was found useful in targeting these groups and identifying participants who were able to provide relevant information related to the study questions. Participants were identified through community groups or organisations serving African populations, as well as through social media (see Appendix J). Flyers containing a brief summary of the study including the study aims, methods and contact details were provided to these organisations and groups (Appendix J). Study details were also circulated through a Facebook, WhatsApp and twitter account created for the study (Appendix J). Interested participants were then required to make contact to express their interest in participating in the study.

7.2.3. Convenience sampling

Convenience sampling is a non-probability sampling technique where the researcher selects participants who are easy to reach or readily accessible (554). The purposive sampling approaches described above proved more useful for identifying women from Nigeria and Ghana, as their communities had a larger presence both physically and online compared to Cameroonian women. More women were therefore recruited through my personal connections and acquaintances (e.g. co-workers and friends). While acknowledging that convenience sampling is highly vulnerable to selection bias and influences beyond the researcher's control (555), it offered a simple and efficient means of reaching more eligible participants, hence increasing the chances of reaching data saturation (556).

7.2.4. Snowball sampling

Snowball sampling is a chain referral technique where existing study participants refer further participants for inclusion in the study (557). This method was used as an extension of both the purposive and convenience sampling methods, to help reach more eligible participants for this study. Women who showed interest in participating in this study nominated other potential participants from

among their acquaintances or social circles, who they believed were eligible for the study. Snowball sampling has proven particularly useful for studies targeting hard-to-reach populations such as ethnic minority groups and deprived populations (558, 559).

7.3. DATA COLLECTION

7.3.1. Participant information

Potential participants were provided with a participant information sheet (Appendix K) informing them about the study's aim and objectives, why they had been approached, what their participation entailed, the type of data that would be collected from them, how their data would be used and how they could get further information. This was aimed at giving them sufficient information about the study, to enable them to make an informed decision about taking part. Participants were made aware that their participation in the study was entirely voluntary, and that they could withdraw from the study at any time. They were also informed that they were going to be asked to provide personal information, including their age, country of origin, marital status, duration of residence in the UK, level of education and age of last child. These were used for the purpose of assessing eligibility for the study and collating sample data.

7.3.2. Interviews

Data for this study were collected through interviews. Interviews can be conducted in a variety of formats, which include structured, unstructured and semi-structured interviews (560). The format used for this study was semi-structured interviews, as they have the advantage of being flexible, allowing for the generation of in-depth data (560, 561). This method uses an open-ended questioning technique to encourage discussion and get participants' opinions on a particular subject (560). It also allows the interviewer to build a rapport with participants, and requires that questions be asked in a straightforward, non-threatening and non-judgemental manner, with the aim that participants feel able to freely express their views (560, 562). The initial focus of the interview is decided by the researcher, who also has the ability to modify, reorder or reword questions, as well as include additional questions

for further exploration (561).

Interviews were conducted face-to-face, in quiet, easily accessible areas such as the University, participants' homes or public spaces around these areas. The most convenient location for each participant was accommodated where possible. In exceptional cases, where participants' locations could not be reached, interviews were conducted by telephone. The decision to conduct some interviews by telephone was influenced by the amount of time spent, and high cost of, travelling to participants' locations across the UK, particularly when participants cancelled at the last minute or did not show up to scheduled interviews.

Telephone interviews have been criticised for being less favourable than face-to-face interviews, due to challenges in establishing rapport with participants, and the inability to observe, pick up or respond to visual cues conveying emotions like stress or embarrassment, especially when discussing sensitive topics (563-565). Other common concerns include participants being more likely to be distracted by their environment (566) and shorter interview durations – hence, less in-depth information – compared to face-to-face interviews (567, 568). However, many researchers have found telephone interviews to be useful in overcoming practical challenges such as cost and difficulty in reaching participants locations; and have noted several advantages like increased scheduling flexibility, increased participant privacy, increased interviewer safety and less influence of researcher characteristics such as ethnicity, age and attractiveness on participant responses (568-572). In addition, some researchers have argued that there is no difference in duration between telephone and face-to-face interviews (572, 573).

7.3.2.1. Participant consent

Each interview started with an introduction explaining the purpose of the research and the topics to be discussed. During this briefing, participants were informed that the information they provide will form part of a PhD thesis, will be published in a scientific journal and will also be presented at conferences. Participants were also made aware that interviews were going to be recorded, and that any information they provided was to be kept confidentially, stored securely and used only for the

purpose of the study. After the briefing, participants were given time to ask any questions, to ensure that they had understood the study aims and procedure. Participants were reminded that their participation was voluntary, and informed of their right to withdraw at any point. Consent forms were then provided for participants to sign, confirming their decision to participate in the study (Appendix L). For participants who were interviewed over the phone, consent was obtained by email and verbally.

7.3.2.2. Topic guide

Part of preparing for semi-structured interviews involves developing a topic guide which includes a list of topics or areas that the interviewer plans to discuss with participants (574). While the interview is not restricted to the topics or questions listed, the topic guide helps to guide the conversations and to ensure that questions asked are within the focus of the study. It also helps the researcher to check, where possible, that all relevant topics have been addressed and includes prompts that can be used to delve further into participants' responses or follow up on particular questions (574). The topic guide used in this study is shown in Table 16.

Table 16: Interview topic guide

1) Perceptions on current and ideal weight (mother and child)

- Current and preferred weight status of mother and child
- Factors influencing women's weight preferences
    - Compare factors in the UK vs back home
- Factors influencing preferences on child weight
    - Compare factors in the UK vs back home

2) Understanding of overweight and obesity

- What it means for someone to have overweight/obesity
- Causes and risk factors for overweight and obesity
    - compare risk factors in the UK vs back home
- Understanding of BMI

3) Awareness of overweight and obesity as risk factors during preconception and pregnancy; and knowledge of risks to mother and child

- Weight preferences before and during pregnancy
- Consequences of overweight and obesity before and during pregnancy
- Influence of maternal weight status on child weight

4) Perceptions on nutrition and physical activity in pregnancy

- Dietary and PA behaviours before and during pregnancy
- Changes in dietary and PA behaviours after migration, and factors associated with these
- Weight management behaviours during pregnancy
    - Compare UK vs back home
- Weight management advice in pregnancy, and sources
    - Compare UK vs back home
    - Advice and sources found to be most useful/helpful

5) Perceptions on influence of maternal weight status on early infant feeding

- Whether maternal weight status influences choice of infant feeding method (breastfeeding or bottle-feeding)
- Factors influencing infant feeding method in the UK vs back home

6) Perceptions on infant feeding on child weight

- Whether choice of infant feeding method (breastfeeding or bottle-feeding) influences child weight status
- Factors influencing child weight in the UK vs back home

7) Anything related to this topic that may have been missed during the discussion

7.3.2.3. Interview recording and storage

Recording interviews helps in keeping an accurate record of participant's responses, enables the researcher to be more responsive during the process, and allows for an in-depth analysis of study data (575, 576). All interviews were recorded using an encrypted digital recorder. The recorder was only turned on after consent had been obtained. Field notes were also taken to enable me to reflect on any key issues highlighted during the interviews.

Recorded interviews were stored on a password-protected university computer, in a building which required a staff card for entry. These were only accessible to the research team (me, my supervisors and two undergraduate Nutrition students from Newcastle University who were recruited to support transcription and initial data analysis). All data storage arrangements were made in line with the University Information Security Guidelines (577) and the Data Protection Act 1998 (578). Participants were informed that all material provided for this study would be destroyed at the end of the study.

7.3.2.4. Assessment of weight perceptions

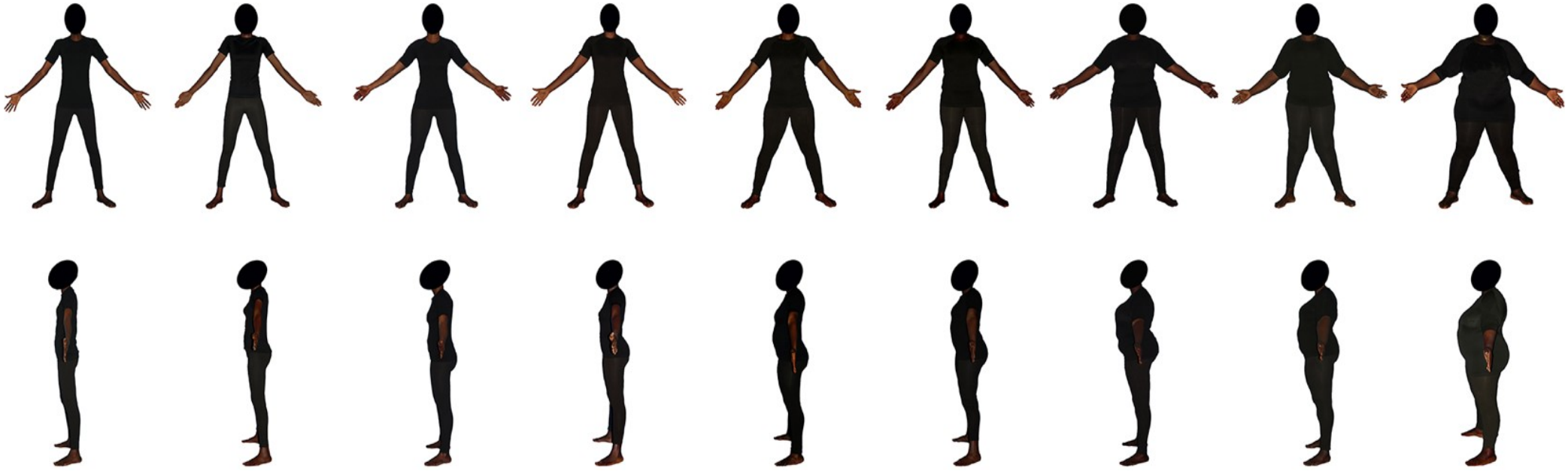
The women's perceptions of women's and children's weight were assessed using visual scales.

(i) Perceptions of women's weights

At the outset of each interview, participants were shown images of women in different shapes and sizes (Figure 25), and asked to share their views on these. BMI-based images depicting different body sizes provide an inexpensive indicator of weight status in the absence of direct anthropometric measurements (579, 580). These have been used in several studies to assess weight perceptions (579, 581-584). The body size scale used was developed in another study using anthropometric measurements of women from two countries in West Africa (Cameroon and Senegal) (585). This

consisted of nine images of body mass indices ranging from 16 to 43 kg/m^2. This scale had the advantage of being based on the BMI of women from a similar ethnic background as my study participants. Other studies have also used these to explore body weight perceptions of African women living in Africa (469, 586) and also in France, a HIC (469). Participants were shown a body size scale card and asked to identify which of the nine images was: (a) a close representation of their current body size; (b) their preferred or ideal size; (c) which image(s) they believed to be of recommended weight; (d) which image they believed to be the start of overweight, and (e) which image(s) they believed to show obesity.

Figure 25: Body size scale used to assess weight perceptions for women of child-bearing age



BMI (Kg/m^2)	16.39	19.17	21.72	24.09	25.76	27.97	32.37	39.03	43.24

Footnote: The BMI scales shown below the figure were not displayed on the silhouette images shown to participants, as this could have influenced their responses.

(ii) Perceptions of children's weights

Common methods used to assess maternal perceptions of child weight status include verbal categorisation and picture scales (587-589). With verbal categorisation, mothers are asked to describe their children's weights (for example as normal, about right, at risk of overweight, overweight or obese), after which these are compared with the child's actual weight status (587, 588, 590). For pictorial methods, mothers are shown BMI-specific images of children at different ages, genders and sometime races, and asked to identify which image is a close representation of their children's current or ideal weights (589, 591, 592). These can also be used to determine any discrepancies between the mothers' perceptions and children's actual weight status (589, 592). Several studies have found picture scales to be more accurate than verbal categorisation (587, 589, 591, 592). It has also been reported that parents may be less likely to describe their children's weights as overweight due to the negative connotations and stigma associated with overweight (593).

As child weight status varies with age, two picture scales were used in this study: one for children under one year of age and another for children aged one to three years. The first picture scale, the African- American Infant Body Habitus Scale (AAIBHS) (Figure 26), consists of 10 images; five boys and five girls, with weight status ranging from 1-thin to 5-obese (594). The second picture scale consists of seven images representing children aged 12 to 36 months of neutral ethnicity and gender (Figure 27) (591). This scale has demonstrated validity and reliability for young children aged 12 to 36 months (591) and has also been used to assess maternal perceptions of child weight status in other studies (595-597). The images represent children in three different weight categories: image 1 represents child underweight; images 2-5 represent normal or recommended child weight, and images 6-7 represent child overweight. Participants were asked to identify: (a) which of the images represents their child's current body size; (b) which image represents the size they would have preferred for their child; (c) which image(s) they believed to be normal child weight; (d) which image(s) they believed to represent child overweight, and (e) which image(s) they believed to represent child obesity.

Figure 26: Body size scale for children aged 0-12 months

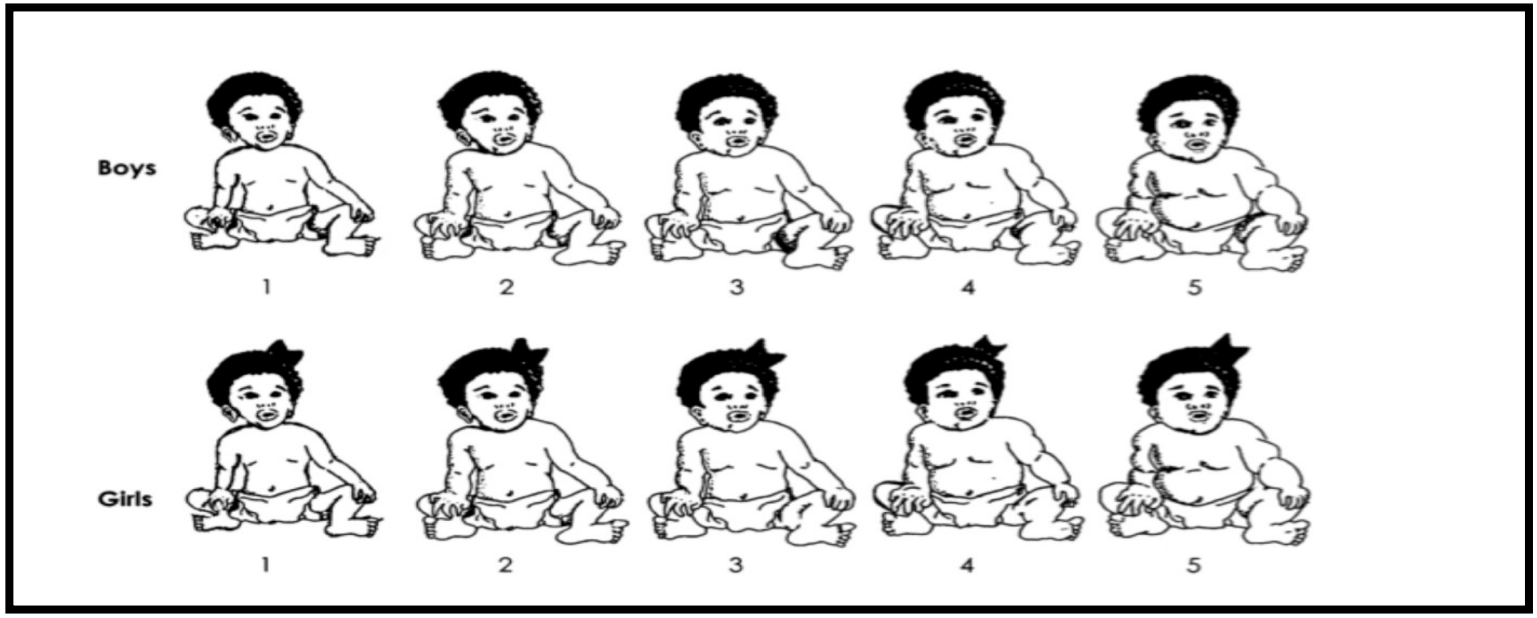
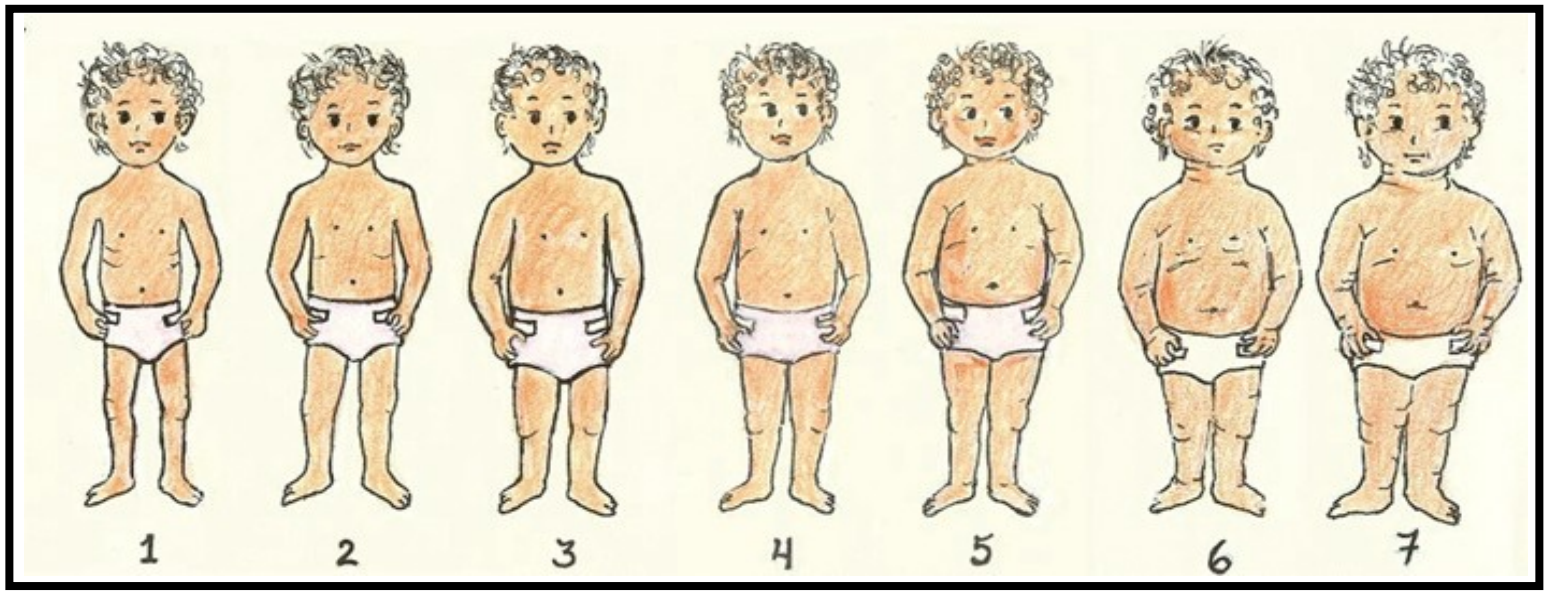


Figure 27: Body size scale for children aged 12-36 months



7.3.2.5. Piloting

The topic guide and body size scales were piloted over a two-day period from the 13th - 14th August 2018. Two women who met the inclusion criteria for the study participated in the pilot. The pilot was carried out to explore the adequacy of the topic guide and images, to explore clarity of interview questions and to test the appropriateness of the research plan. No changes were made to the interview questions or images at the end of piloting.

7.4. DATA ANALYSIS

7.4.1. Transcription

Transcription is the process of providing a written account of recorded interviews, and is one of the most common methods used to prepare qualitative data for analysis (598, 599). Data transcription was undertaken at the university, by me supported by the two undergraduate students. Standardised transcription procedures were used to ensure that transcripts were a true reflection of participants' responses. For consistency in transcription, I trained the students on the transcription process and talked them through a sample transcript I did. In addition, the assistants were sent a summary of the study's proposal to familiarise themselves with the topic guide and some of the terminology that they may encounter.

MacLean et al. (600) suggest that a sample of transcripts be cross-checked to identify any issues relating to content or quality. Following completion of the pilot interviews, I checked all transcripts to identify any errors or inconsistencies. The only problem identified was a few words said by participants which were not audible enough to the transcribers. These were all resolved after cross-checking. To ensure that all relevant information provided during the interviews was captured in the transcripts, all transcripts were checked by me against the original interview recording. Cross-checking was also useful for familiarisation with the data, which is an important step in the data analysis process. After transcription, all audio recordings

were permanently deleted and transcripts were anonymised before analysis to ensure participant confidentiality.

Several software packages have been developed for use in managing large amounts of qualitative data in a systematic and efficient manner. While acknowledging that these do not replace the researcher's skills, time and effort, these packages have proven useful in enhancing the rigour of the data analysis process, and quality of study outcomes (601). Following transcription of interviews into Microsoft Word, the data were stored and managed using NVivo-12 (601).

7.4.2. Thematic Analysis

Thematic analysis is an approach used to analyse and identify patterns within qualitative data. As described by Braun and Clarke (602), it is the process of identifying, examining and recording patterns in data related to a specific research question. This method enables the researcher to describe the data in rich detail, allowing for interpretation, while also establishing links between the identified themes and study objectives (603). Thematic analysis differs from other qualitative data analysis methods like grounded theory, discourse analysis, framework analysis or content analysis in that it can be used in combination with a wide variety of frameworks (604). For these reasons, thematic analysis was considered appropriate for this study.

The analysis process followed the guidelines provided by Braun and Clarke (602). This began with the reading of transcripts, which was done repeatedly to become familiar with the data. Initial codes were noted down during this stage, followed by line-by-line coding of transcripts to identify relevant codes. Similar codes were then grouped together into potential themes. As the thematic analysis process is not linear, earlier stages of the process were repeated as required, until no new codes or themes emerged from the data (see coding example of transcript excerpts in Appendix M).

To ensure that the themes reflected the most important data addressing the study objectives, some themes were considered not appropriate for inclusion. These included themes that were not sufficiently represented in terms of frequency and importance (605). Frequency was determined by the number of participants commenting on a specific idea, and was used to capture recurrent codes. However, as stated by Braun and Clarke (602), 'the mere recurrence of codes is not necessarily a sufficient criterion of their importance'. Buetow (605) proposed the concept of saliency analysis to help identify codes that may be important, but not recurrent. Saliency analysis enhances thematic analysis by explicitly considering both the recurrence and importance of individual codes. The process involves the classification of codes into one of the following categories: (1) highly important and recurrent, (2) highly important but not recurrent, (3) not highly important but recurrent, and (4) not highly important and not recurrent; where categories 1-3 highlight salient codes. As decisions relating to frequency and importance are inherently subjective and thus, subject to researcher influence, the saliency analysis process helped minimise the impact of my preconceived ideas and knowledge of the evidence base on the analysis.

7.4.3. Incorporation of thematic data into theoretical frameworks

Following the thematic analysis process, the themes emerging from the data were incorporated into two health behaviour theories: the Health Belief Model (HBM) (606, 607) and the Theory of Planned Behaviour (TPB) (608). This was done to explore the data in a different dimension, in the context of existing theories on health perceptions. The HBM, commonly used in disease prevention programmes, predicts that an individual's beliefs about a health condition, perceived benefits of (in)action and self-efficacy determine their health-related behaviours (609). This framework is often used to explain why individuals engage in or change certain health behaviours, and has been used in various studies aiming to develop culturally-appropriate weight management strategies (610, 611). The TPB, on the other hand, suggests that behavioural intent is influenced by the value an individual places on a particular behaviour, their perceived ability to engage in the behaviour and the perceptions of how others would

view the behaviour (612). This theory is useful for understanding behavioural intentions and influences on these (612). It has been used successfully to assess and predict a number of health-related behaviours such as doing exercise and health screening (613-615). I used constructs from these two models to provide coherence to my study findings, and to enhance the synthesis of the personal, environmental and social factors that influence my participants' weight perceptions and behaviours into a meaningful account.

7.4.4. Presentation of findings

The results from this qualitative research are presented in Chapter 8. I present the themes identified, and also incorporate some discussions of relevant literature around them. Participant identification numbers are provided for longer person-specific quotes, while commonly held views or terms used by many women are not tied to any identification numbers.

7.5. ETHICS APPROVAL

Ethical approval for this study was obtained from the Newcastle University Faculty of Medical Sciences Ethics committee (reference number 1619/7864/2018) (Appendix N).

7.6. QUALITY ISSUES IN QUALITATIVE RESEARCH

Qualitative research has been critiqued for lacking scientific rigour, based on debates around the principles of generalisability, reliability and validity, which govern quantitative research (616, 617). While some argue that alternative parameters like credibility, transferability, and conformability are more applicable to qualitative research (618, 619), others maintain that the same principles as for quantitative research apply, though with modifications to account for the different features of qualitative research (620).

Qualitative studies are traditionally not generalisable as each study looks at a specific phenomenon in a particular population, group or context (621). Nonetheless, the concept of generalisability can be applied in various ways, for example, by ensuring that the study sample offers a coherent reflection of the population or phenomenon under study (622). To enhance

the representativeness of the study sample, participants were recruited from various sources (e.g. through women's places of work, education or social interaction) and participants included women from diverse demographic backgrounds as is the case in a natural community setting (e.g. different age groups, different academic backgrounds, different marital status, different durations of residence in the UK, different number of children).

Reliability refers to the extent to which study results are consistent over time and whether these can be reproduced under a similar methodology (623), while validity is an indication of how accurate study findings are (624). Determining validity and reliability can be challenging for qualitative research, as the focus of such studies relies on various paradigms and context-specific factors like individual experiences and social interactions, which are prone to misinterpretation or bias (622). Hence, the reliability of qualitative research relies on the consistency and transparency of the methods adopted (625). Enhancing reliability can, therefore, be done by fully describing the processes involved in the study, following a systematic method during data collection and ensuring that any interpretations made are supported by the data (622). Bolderston (626) outlines various ways through which study accuracy can be enhanced. The concepts of validity and reliability for this study were addressed in the following ways: by using a consistent data collection approach, ensuring that questions asked were relevant to the research objectives and giving enough time for participants to think and respond; by restating participants' responses and clarifying any uncertainties with participants during interviews; by confirming interpretations of interview data through discussions with supervisors; by ensuring that all interpretations were data-driven and contained a strong sense of the participants' voices; by providing excerpts of the interviews within the report; and finally, by ensuring that conclusions drawn were an accurate reflection of the data provided by participants, and also supported by findings from the literature.

7.7. RESEARCHER POSITIONALITY AND REFLEXIVITY

The way in which a research study is approached, analysed and evaluated can be influenced by the researcher's stance or positioning in relation to the study context (627). As qualitative studies are contextual and take place within a specific time and place, recognising factors that influenced the researcher's relationships with participants and the researcher's interpretations gives a deeper understanding of the work and helps increase the creditability of findings (628, 629). I present a critical reflection of how my perspectives, experiences, and actions may have influenced the research process and study outcomes.

7.7.1. Researcher identity and the insider/outsider divide

A researcher is said to be an insider when they are a part of the social group they are investigating – for example, sharing the same ethnic, national, cultural or religious background as the researched group or individual (630). Conversely, an outsider is a non-member of the group. As an African migrant woman of child-bearing age living in the UK, I was, by this principle, an insider to my study population and to the issues being researched. I also shared cultural commonalities with my study participants, which made me a cultural insider, according to the cross-cultural research framework proposed by Banks (631). Being an insider, it is assumed, is helpful in establishing rapport with study participants and obtaining more intimate and authentic knowledge (630). Being a cultural insider is further recognised as a strength that allows the researcher to get closer to participants (632). As I prepared to carry out my interviews, I expected that my position as an African migrant woman and my African cultural background would help in connecting well with my participants. Such an expectation is reasonable, based on findings suggesting that people tend to gravitate toward those with whom they share some commonalities (633). While this was true for the most part, my lack of experience with child-bearing, which was one of the main focus areas of my research, was somewhat of a barrier during my interactions with some participants. On finding out that I had no children, I noticed that some participants became reluctant to share their views or experiences (especially relating to their challenges), often because they felt – as they said –

that I would not understand. In addition, I felt with some participants, that once they became aware of my academic background, they tended to skew their responses towards what they thought was ‘appropriate’ or ‘right’ to say, rather than sharing the reality of their perceptions and experiences. Engaging with these participants became more difficult than I had anticipated, and I felt that I somewhat became an outsider in these instances. As I learned, I may have taken my positionality for granted in attempting to engage with my participants.

Researchers have expressed their frustration with the oversimplification of the insider/outsider divide, emphasising that it neglects diversity within groups to which both the researcher and the interviewee belong, and obscures the diversity of experiences that can occur between the researcher and the researched (634-636). It’s also been noted that traditional literature tends to gloss over the complexities of insider/outsider status, and that researchers may not be well supported in their attempts to navigate these dilemmas (637). In discussing the implications of a researcher’s identity in migration research, Fedyuk (635) outlined that no identity can be sufficient to secure the insider position, and that different aspects of identification can become more prominent than others during each interview. Being an insider has been redefined as situated and contextual (638), as it is widely acknowledged that the insider/outsider status is subject to negotiation between the researcher and their participants (639). Thus, while shared ethnic identity can prove useful in having easier initial access to migrant groups, identities might break further into a myriad of other positions, for example based on age, experience or education; and some positions may facilitate rapport with participants, while others might hinder mutual trust. What I learned from my reflection of my identity and insider/outsider status is that, at each stage of the research process, both the researcher and their participants actively negotiate positions, and it is important to incorporate these into the research design, with critical reflection.

Being cognisant of my insider/outsider position enabled me to think about approaches that could be helpful for engaging more with my participants. Approaches I found to be particularly

useful were repeating what the participant said about the question asked and showing an interest in learning more about it; sharing (very sparingly) what I know about the subject; and acknowledging my inexperience beforehand while reassuring participants that sharing their views would be helpful for identifying issues relating to maintaining healthy weights and improved health for African migrant women and children. In doing this, I realised that through my interviews, I aided in creating spaces through which these women could voice some concerns that they had 'never really had an opportunity to talk about' (as evidenced through their comments and remarks at the end of the interviews).

7.7.2. The interview approach - playing a dual role

Prior to starting my interviews, I worried about how much the interviewer should say, whether it would at any point be necessary to put my views out in the open, and also whether this would in any way mean I was 'contaminating' the data. Guided by my previous experiences of doing qualitative research and conducting interviews, I was aware that sharing too much could impact on participants' responses, or make them hesitant to share their views. However, my interactions with two of my participants with whom I had interacted closely or worked with in the past felt strange, especially knowing that they knew (to some extent) my perspective on the subject. The desire to join in the discussion was an issue I had to resist throughout. I felt as though our conversations were not the natural, free-flowing conversations they could have been in our everyday, non-interview setting. I probed and encouraged discussion as much as I could, but playing the dual role of interviewer and friend or ex-colleague was a challenge. I remember feeling a little worried sometimes that my conversations may have switched from researcher-participant to friend-participant. I also felt some confusion, as there is no consensus on how much an interviewer should reveal and how to strike a balance between saying enough and keeping the focus on the participant's opinion. While a pre-existing relationship can enhance rapport development with participants, what I learned from my reflection and reading on the subject (640), is that it is important for the researcher to continually be aware of the potential for role confusion to arise during interviews, and how this

may influence data collection with known participants. Despite the challenges, the interviews went well overall and the data I collected was a reliable reflection of my participants' views and perceptions.

7.7.3. Here to help?

Beaver and colleagues (641) note that regardless of discussing boundaries and the aim of qualitative research being to gather information, participants tend to assume that the researcher is in a position to help them. On several occasions, participants asked about my opinion and whether what they were saying was true or right (for example, when discussing the meaning of BMI and different weight categories). Asselin (642) emphasises on the importance of explaining the intent of an interview at the outset, and clearly stating that the primary aim is to generate data. He adds that if there is an intention to provide feedback or advice following the interview, then this should also be made clear from the start. As the provision of feedback or advice was not part of my aims, I fully informed all participants of the purpose of the interviews prior to starting. However, I sometimes found myself in a difficult position when participants asked for explanations relating to some of the topics discussed during the interviews. The guidelines propose that participants be debriefed after interviews by providing them sources of further information, which I did. Though I followed this protocol (see Appendix O), I feel I may have appeared uncaring at times, or let some of my participants down, especially when I got a little carried away by interesting or 'juicy' data, at which point I may have paid less attention to their questions.

7.7.4. The interpretation crisis

The researcher in qualitative research is considered to be the primary data collection tool, and has the potential to influence the data either during the process of data collection or interpretation. Data analysis can also be influenced by the researcher's preconceived ideas or experiences, and so it is important that these be recognised and critically evaluated (643). Thematic analysis acknowledges that the researchers' knowledge and understanding of the

subject can shape data analysis. However, how the researcher's own knowledge or understanding can impact on this is not well understood. As previously mentioned, I am an African migrant woman, and I am not neutral to the issues being explored in this study, as I am aware of some of the social circumstances surrounding migrating from an African country to live in a HIC, through my own experiences. I have opinions and concerns relating to weight status and weight-related behaviours in the context of an African migrant. On the other hand, I also have knowledge of the literature on this subject, and goals I hope to achieve from my research. There have been moments when I questioned how suitable I was as a data gathering and analysis 'instrument' for this topic. My aim, however, was not to show whether my participants' views around weight status and obesity were right or wrong, but rather that they may be different from ones outlined in the current evidence base. That was, and still is, my agenda.

At the beginning of my meaning-making of participants' perceptions, I was concerned that my interpretations of their views might portray them in a negative light. I wondered how they would perceive my interpretations, and whether they would appreciate me positioning them as vulnerable. However, as previously mentioned, my interpretations were driven by their views, supported by the literature and aimed at presenting the evidence around factors influencing maternal and child weight status in the African migrant population from a lay perspective.

CHAPTER 8: PERCEPTIONS ON OVERWEIGHT, OBESITY, WOMEN'S WEIGHTS AND WEIGHT-RELATED BEHAVIOURS

8.1. CHAPTER INTRODUCTION

Women's weight perceptions including their understanding of overweight and obesity can contribute to their weight management behaviours, weight preferences and weight- related behaviours (644, 645). Chapter 5 of this thesis identified African migrant women living in HICs as a vulnerable group for overweight and obesity, providing evidence for the need to support weight management in these women. To be able to meet this need, it is also important to have an understanding of the women's weight perceptions, as well as the sociocultural and migration-related influences on these.

Several studies have looked at weight perceptions of Black women in HICs, and typically show that Black women have larger body ideals and higher weight preferences compared to women from other ethnic groups (280-285). However, as outlined in chapter 1, the Black sub-group in HICs usually includes both migrant and non-migrant populations. This means that the findings from these studies on Black women may not coherently reflect the weight preferences or perceptions of African migrant women. It could also be that some findings specific to the weight preferences of migrant women remain unknown. Weight perceptions of migrants may differ from those of non-migrants as a result of different beliefs, cultures or migration-related factors, which may not be applicable to non-migrants (646). For example, I showed in Chapter 5 how moving from an African country to a HIC influenced changes in women's dietary and PA behaviours. These changes occur as a result of migrant women experiencing a new food and living environment, and having to navigate a different social living context than the one they

have been used to most of their lives. The case is not the same for non-migrant women who have lived their entire lives in HICs.

In line with current evidence on risk factors for overweight and obesity, the unhealthy behaviours that African migrant women adopt after migrating to a HIC as presented in chapter 5 can be understood as contributing to their increased risk of overweight and obesity. Perhaps, a potential solution could be to sensitise the women about these unhealthy behaviours, or to design interventions aimed at promoting the uptake of healthy weight-related behaviours after migration? Certainly, these could be helpful, but not without an understanding of what the women identify as healthy or unhealthy, or even what they consider to be a risk, and also how these ideas are formed. Amidst all the evidence I have found, what remains unclear to me, is how African women's thinking and reasoning drives the behavioural changes they make after migrating to a HIC. What are their general beliefs about overweight and obesity? What do they consider to be the risks and what is their approach towards these risk factors? What do they think about their body weights and what factors enable or hinder them from maintaining healthy weights both before and during pregnancy? To my knowledge, there is a lack of studies exploring African migrant women's perceptions on the risks and implications of overweight and obesity during child-bearing age. Most importantly, how has migrating to the UK influenced any of these ideas, weight preferences or weight-related behaviours? These are the questions I will be addressing in this chapter.

8.2. DESCRIPTION OF STUDY PARTICIPANTS

The characteristics of the women who took part in this study are described in Table 17. Participants were 23 women from Ghana, Nigeria and Cameroon, aged 23 to 41 years old, who had lived in the UK for an average of 6.8 years. A majority of the women were either married or cohabiting (n=19), had two or more children (n=15), had studied up to university level or higher (n=16) and were employed (n=17). Five women were pregnant during the interviews, three of them being pregnant for the first time.

Table 17: Interview participant characteristics

Characteristic	Total number of participants (n=23)
Age, mean (range)	30.7 (23 – 41)
Country of origin, n • Nigeria • Cameroon • Ghana	 9 8 6
Duration of residence in the UK, n • Pregnant at time of study	7months – 22 years (mean 6.8 years) 3
Total number of children, n • 1 • 2 • 3 or more	 5 9 6
Pregnant at time of study, n	5
Level of education • Completed secondary or pre-university education • Attained education at University level or higher	 7 16
Marital status • Married or co-habiting, n	 19
Employed, n	17
Region of residence, n North and North East (Newcastle, Liverpool, Manchester, Durham, York) Greater London South and South East (Reading, Guildford, Bicester, Oxford) West Midlands (Birmingham, Coventry, Wolverhampton, Dudley, Smethwick)	 6 5 5 7

8.3. CONCEPTUAL FRAMEWORK OF THEMES AND SUB-THEMES

Figure 28 highlights the main themes (blue boxes) and sub-themes (grey boxes) that emerged from the participants' responses. The arrows represent interactions between the various themes; that is, showing that they had influences on each other. The modifying factors shown on the left-hand side of the figure are factors that were embedded throughout the themes and

sub-themes, and thus, contributed to the women's thinking and meaning-making during the formation of their perceptions.

One of the key observations from this chapter – as discussed in the coming sections – is that the women's weight perceptions and related behaviours were influenced by both pre- and post-migration factors. This is illustrated in Figure 29, which shows how factors related to being in the UK as compared to being 'back home' (in the women's countries of origin) either enabled or prevented them from maintaining healthy weights both before and during pregnancy.

Figure 28: Conceptual framework of African migrant women's perceptions on maternal and child overweight and obesity

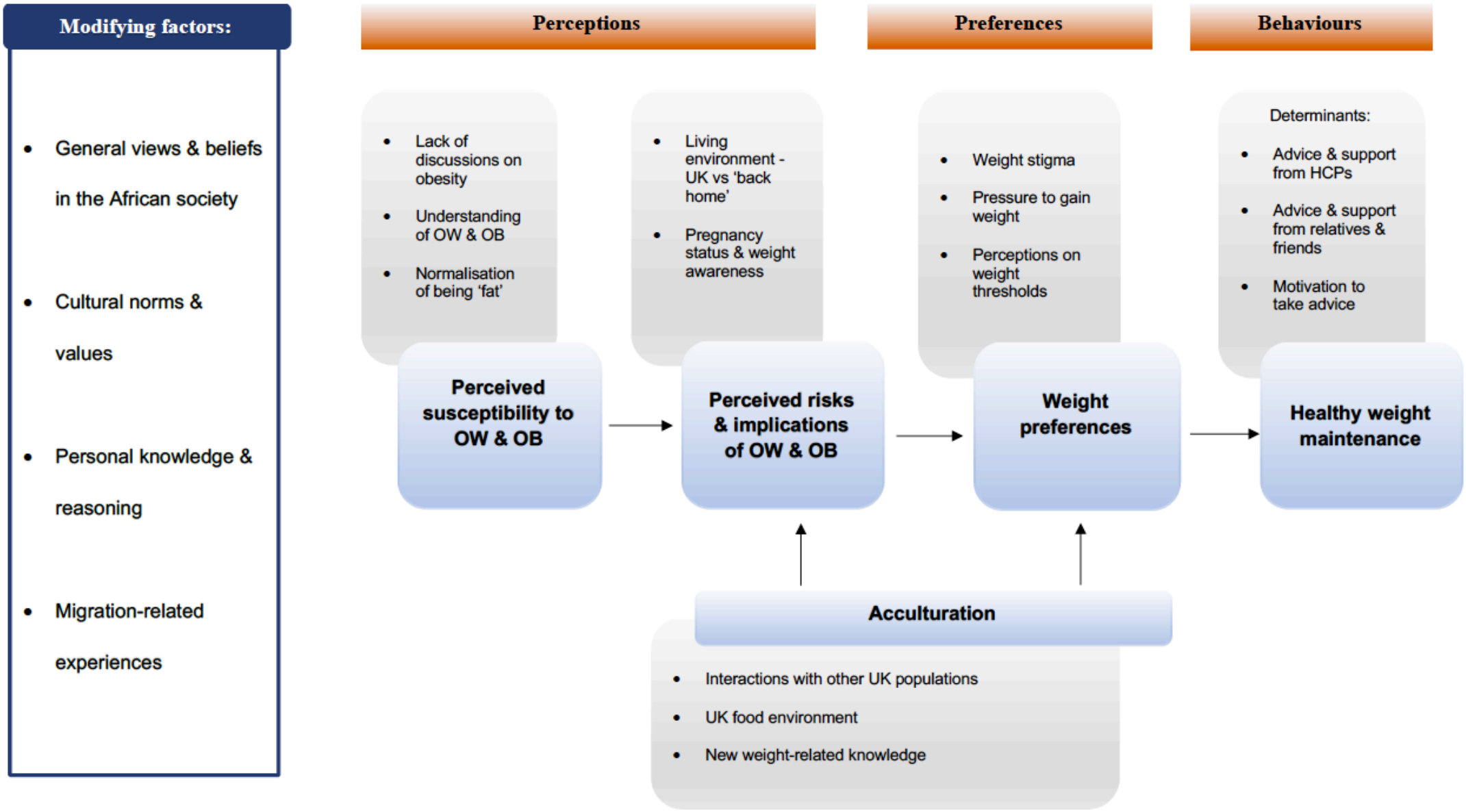
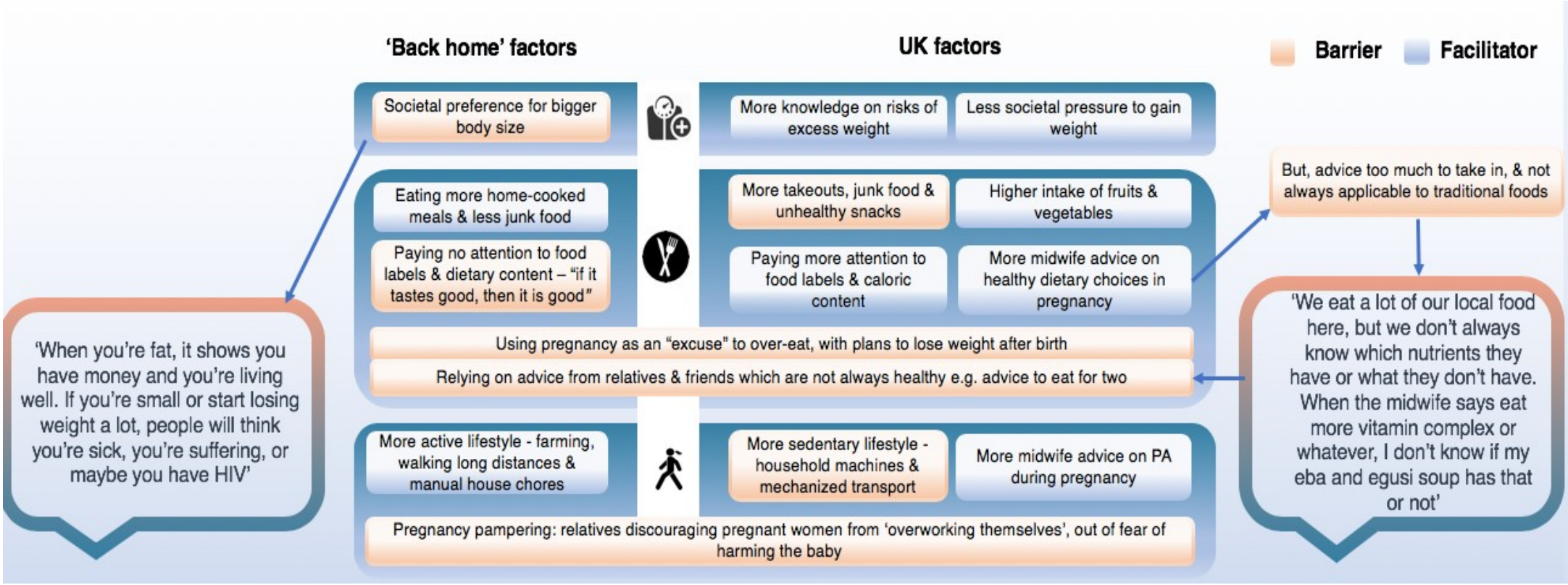


Figure 29: 'Back home' and UK factors influencing women's weight perceptions and weight-related behaviours before and during pregnancy



8.4. DESCRIPTION OF THEMES AND SUB-THEMES

Five overarching themes are described in this chapter, which are: (i) 'we are not at risk' – everyday perceptions around susceptibility and causes of obesity and overweight; (ii) bigger is better: orders of weight-related stigma; everyday perceptions around susceptibility and causes of obesity and overweight; (iii) acculturation: towards new weight perceptions; (iv) shifting dietary behaviours after migration and (v) weight management in pregnancy: actions and support.

The first theme (8.4.1.) describes the women's narrations on general beliefs about overweight and obesity among African women, and their perceptions of the factors associated with an increased risk of overweight and obesity. In the next theme (8.4.2.), I describe factors that influence the women's ideas of healthy or ideal body weights, including the role of weight stigma as experienced both in the UK and back home. This is followed by a description of the women's weight preferences and the influence of acculturation on their weight perceptions (8.4.3.) and behaviours (8.4.4.). The last theme then explores actions taken by the women to help them maintain healthy weights during pregnancy, and how they are supported towards this aim (8.4.5.).

8.4.1. 'We are not at risk' – everyday perceptions around susceptibility and causes of obesity and overweight

The idea that overweight and obesity are mainly 'a problem of the western world' was evident in this study. Throughout the interviews, obesity was somewhat situated as the exception–as something they do not regularly encounter in their daily lives. Participants outlined that obesity is not a part of their everyday discussions, and that when it comes to health, 'it's just not one of the things we talk or worry about' (P3). While acknowledging that 'many African women are big' in size and that there is a possibility that 'some women can be overweight', the participants

believed it would be ‘rare’ to find an African woman with obesity. Being ‘fat’ was rendered as a ‘natural thing’ for women, particularly around key stages of life:

> Many women are fat (…) fat is a natural thing especially when a woman has grown mature and started having children (P1).

Maturity and childbearing were cited as two factors commonly associated with overweight, hence the view that it’s ‘normal’ for a woman to be ‘fat’ in her reproductive age. Thus, having an overweight BMI as an adult woman would not be seen, or thought of, as a cause for concern.

Participants strongly believed that Africans are generally ‘not at risk’ of obesity, based on their understanding of the disease, which they described using physical features as being ‘too fat’, ‘too big’, having a ‘hanging belly’ or ‘when you can visibly see bulges’. Very few women related overweight and obesity to health. Interestingly, some of the participants made a distinction between the two weight categories, implying that obesity is a health problem, while overweight is not:

> Obesity is when your weight is too high for your age and is now a medical problem, because it’s above overweight (P3).

Similar misconceptions about the terms ‘overweight’ and ‘obese’ have also been reported for non-African women (647-649). In addition, women have also been shown to have a poor understanding of important weight-related concepts such as BMI (647, 650). While most of my study participants were familiar with the term BMI, they had different interpretations of its meaning. For example, BMI was thought to be ‘the difference between your weight before and after pregnancy’ (P8), ‘a given weight that should be attained at every age’ (P2), or ‘an average weight that should not be exceeded’ (P1). These findings highlight a knowledge gap for women

of reproductive age, which could potentially be an important step towards obesity awareness raising. Increasing awareness or understanding of BMI may be beneficial towards supporting weight management for women of child-bearing age. While I acknowledge that awareness of public health terminologies or guidelines does not necessarily lead to reductions in risky behaviours, it is also understood that obesity risk may not be realised if an individual is not aware of their BMI, or of its significance (651).

In addition to physical characteristics, participants also described what they believed to be the capabilities of a person with obesity, which included being 'unable to walk because you're too fat' (P2) and being 'unable to do anything':

> We watch programs about people that are obese and you'll always see them sitting in one place…other people have to bathe them, do things for them. Many times you'll also see them using a wheelchair…in Africa you will hardly see things like that (P1).

Their descriptions of obesity were mostly characteristics associated with extreme obesity, and these features were allegedly 'not common' among Africans. Having obesity was thus positioned as an altogether different experience, outwith their everyday experiences.

A second reason why participants questioned the risk of obesity for African women was because they were positioned as being 'always active', 'always busy' and 'hardworking'; so despite being 'fat', they considered them less likely to be at risk. This view aligns with the controversial fat but fit paradox, which alludes that one can be overweight and still healthy. Some participants however, shared an alternative view, that the lack of discourse on obesity among Africans and the belief that Africans are not at risk of obesity are some of the key reasons why African women are less cautious about their weights:

> Everyone should be careful about their weight, but people cannot be careful about something they don't hear about, or something they don't see as a problem. That's why women don't care about their weight (P7).

The above quote highlights the fact that specific cultural narratives around weight can impact how people may visualise, value or reflect on their body shapes and sizes.

- **Living the 'easy life' in the UK**

In discussing factors associated with an increased risk of developing overweight and obesity, living in the UK was identified as a significant contributor, in that 'here you live the easy life', as compared to the lifestyle 'back home' which they described as 'more active'. Participants cited various examples illustrating the UK's obesogenic environment, which included: cheap unhealthy food, a higher tendency to consume unhealthy snacks and sweet drinks, less walking due to over-reliance on mechanised transport and less household work (both in amount and intensity) due to access to household appliances:

> Here we have hoovers, mops, washing machines and things like that to facilitate your work, so it doesn't take long to clean. But in Africa, first you have to bend down to sweep (…) sweep with the local broom, bend down to put the rag in water, squeeze and mop, and sometimes - sometimes you even have to go on your knees to scrub the floor (P5).

This participant (P5) describes women being 'more active' in Africa because most tasks, like house chores are done manually, and usually on a daily basis. Women also made comparisons of the types of activities or work that women do in Africa, which they described as 'more energy-demanding' than in the UK. For example, farming is commonly practised by many women in Africa, and sometimes 'very far' from women's homes, without tracks that cars can use, thereby requiring that women walk long distances. They contrasted this with the

lack of farming in the UK, where 'you can only go as far as doing a bit of gardening near your house if you want to grow a few crops' (P4). When describing their lives in the UK, women commonly made statements like 'it makes people lazy' and 'it's very easy to get fat here'.

The image of people 'back home' being 'very active' was however, not consistent, as women also identified that 'things are changing' and that many parts of Africa - especially urban areas - are starting to be 'a lot like some developed countries'. For example, walking long distances to the market, which used to be frequently practiced, is now almost non-existent in some local communities, due to the increased use of cars, and the availability of motorcycle taxis which are 'cheap' and 'always available'. 'You find them everywhere, and the cost to the market and back is not even up to 50p,' (P13) one of the women stated. These motorcycles also had the added advantage of being able to travel on roads that cars could not use, and were therefore used in some communities to travel to farms. In trying to explain the reasons behind these cultural shifts, women identified having lived in a developed country as having a big influence on their reduced PA levels when they returned to their home countries:

> My mom and I used to walk to the market all the time, it's like a 25-30 minute walk (…) When I came to the UK, I became used to driving everywhere, you know, or riding the bus or the train…so now when I go home, you will rarely see me walking. If I need to go even to the corner shop, I'll just get in my car and drive. I always go to the market with either my mom or my sisters – my siblings, so now they also do same, drive or call a bike (P14).

Living in the UK was reported as having changed this participant's commuting preferences, and she also described how she had influenced the commuting behaviours of her relatives. Other women cited examples of how they influenced the way things were done by their relatives back home, such as buying and shipping hoovers and washing machines to 'ease the work' of their relatives, or introducing eating convenience foods 'to save time'.

Despite identifying living in the UK as being associated with an increased risk in developing overweight and obesity, the belief that Africans are not at risk of obesity, and that obesity is mainly a problem for HICs, remained. Participants were generally surprised to hear that the prevalence of overweight and obesity among Africans living in the UK and other HICs is high compared to other ethnic groups. Participants questioned this evidence by asking questions like 'is that what they are saying?' (P3) and 'where are the obese women that we're not seeing?' (P5). Other women challenged this evidence, one of them stating 'for every African woman who is overweight, I can show you ten who are not African' (P8). These reactions and responses indicate that the women's lay interpretation of what they see on a day-to-day basis does not correspond with the statistics on overweight and obesity. Meanwhile, women who thought this evidence 'could be possible' were convinced that 'if it's true then it must be women who grew up here' (P2); hence suggesting that the increased prevalence and risk pertains to non-migrant African women.

- **Food, genes and pregnancy, but not PA**

Unhealthy dietary behaviours featured as one of the dominant causes of overweight and obesity, which women described as 'eating junk food', 'not controlling your appetite' and not regulating dietary intake (commonly phrased as 'eating anyhow'). Although participants admitted that exercising control over dietary intake could be challenging, for example, during pregnancy or when surrounded by unhealthy food as is the case when living in a HIC, the women believed that obesity develops progressively, and 'people should be able to notice when they are getting too fat' (P1). This view represents one of the common narratives about the underlying causes of obesity – that obesity is caused by a lack of personal motivation; and its defining characteristic being to blame people for having an overweight or obese BMI (652). People with obesity were rendered as culpable, with emphasis on the notion that obesity mainly results from poor individual decisions and that they were 'negligent' about their weights. Participants also blamed close relatives of people with obesity for 'not caring enough' to advise them or to encourage them to take action concerning their weights:

> I saw one woman on TV, she was like maybe 8-10 times my size. The husband was the one taking care of her…doing everything…it kept me wondering…where was he when she was putting on all that weight? (P3)

The care giver is blamed in this case, for not intervening early enough, which the participant believes could have helped in preventing the woman from developing obesity.

Some participants offered lay theories to explain why relatives of people with obesity may be silent about the situation, one being that 'discussing someone's weight can be very difficult' (P4), more so in HICs than 'back home' where 'it's not a problem to tell someone that they're getting too fat' (P14). Telling someone in an African country that they gained weight mostly elicited feelings of pride and satisfaction; and even when directed at someone who was trying to lose weight, such remarks were often taken 'less harshly' than in the UK, where people are seen as 'very sensitive about their weights' (P1):

> I have friends who avoid me up till now because I always made comments about their weight. We came to the UK about the same time, that was like 11 years ago... They've gained so much weight…for me, I was only trying to bring their attention to it. People tell me every time that it's insensitive to talk about people's weight like that, but I don't see – I don't see why, what's wrong with it. Back home, it's a normal thing. (P7)

She outlines how weight-related talk can be embedded in social and cultural norms, and in this context, how the process of acculturation around discussing weight reframed the norms of her relationship with her friends. Participants also mentioned that 'sometimes you lie to them about their weight' (P11) or avoid the subject altogether, in order not to hurt them:

> My sister is very worried about her weight. She always, always talks about how she's getting fat, oh this…and it's true. But every time I lie…I lie to her that she's lost some weight, just so

> that she doesn't feel bad, you know? She has a terrible eating habit, but I don't know how to tell her. I just avoid it and hope maybe someone else would tell her (P11).

This view reflects how acculturation can change people's behaviours towards loved ones with overweight; such that they may no longer be open to discussions about weight. However, it also shows that, irrespective of context, people can, at some point be sensitive about weight.

While dietary reasons dominated the conversations on causes of overweight and obesity, PA was seldom mentioned. The women mostly interpreted PA as sport or exercise, and these were mainly regarded as activities for males or athletes. Aside from these trends, women also believed that doing sports is not an inherent part of their culture, so even those who practice it do so by their own volition, and not because they are encouraged to. Thus, in response to how not being physically active could contribute to overweight or obesity, one of the women noted:

> I won't consider this a factor [for African women] because it's just not something we do. It's not in our nature to do exercise anyways, our culture does not promote it. Even people that are healthy–women, or even men, it's not because they exercise. (P6)

Women were positioned as rarely engaged in such activities because they were usually busy with their multiple daily tasks and had 'other important things to do' (P3).

In addition to dietary causes, overweight and obesity were also believed to result from factors outside their control. For example, participants identified that a person could be predisposed to overweight and obesity through genetic factors, in which case they would inevitably develop overweight or obesity. Pregnancy and childbirth were also cited as two prominent causes of excess weight gain in women, which could potentially lead to overweight and obesity. Women believed that the amount of weight gained in pregnancy and the causes of this weight gain are

'uncontrollable', as they are linked to biological factors such as hormones and the fetal environment. Also, fat amassed during pregnancy was seen as different from 'normal fat', and 'more difficult to lose' (P5):

> When you're pregnant you have to gain weight. They say there's an amount of weight that is healthy for pregnant women, but you cannot control it, because…it's not like normal fat, it's caused by hormones and the uhmm, the water that holds the baby. You cannot lose it easily, so it accumulates when you start having more children. That's why you see a woman starts getting fat when…when she starts having kids and there's nothing you can do about it (P10).

As the participant described, women felt they had no control over maternal overweight and obesity due to the unavoidable weight gain in pregnancy, and the accumulation of fat through subsequent pregnancies. Many women also felt there was 'no need' to work towards losing the extra weight while still having plans to conceive, as 'you'll probably fall pregnant again in like one year or two' (P5). Most women therefore planned to have all their children before planning how to manage their changed bodies. Some women considered undergoing liposuction in case losing weight proved difficult after having had all their children.

8.4.2. Bigger is better: orders of weight-related stigma

To better understand how African migrant women's weight perceptions are formed, I started by exploring the general views about women's weights in the societies from which they had migrated. Discussions about weight in the UK are usually intertwined in a specific discourse of public health, centred on risk and obesity. This differs from the milieu from which these women migrated, where being 'fat' is affiliated with affluence, and seen as a 'sign of good living':

> When you're fat, it means you're eating well, you have money and you're living a good life. For a woman…a married woman, it shows that your husband is taking good care of you…people envy that (P5).

This description tells of a cultural preference for bigger body sizes in their countries of origin, and thus, women growing up in this context may desire or be encouraged to be 'fat'. Several women talked about having felt pressured at some point of their lives to gain weight, especially from their mothers, husbands or siblings, because bigger body size 'is a sign of good health to them' and 'it's the right size for a woman'. This is very different from HICs like the UK where excess weight gain is cautioned against and 'interpreted as a bad thing' (P4).

In an era when overweight and obesity are prevalent throughout the world, there is a correspondingly pervasive culture of weight-related stigma. Goffman (653) describes stigma as 'a trait which is deeply discrediting'. Stigma is characterized by social exclusion, rejection or devaluation as a result of a person or group not complying with prevailing social norms (653). The causes of stigma, and how people respond to it, varies from one social setting to another. Stigma towards overweight and obesity is pervasive in HICs, where high body mass symbolises negative attributes like laziness and lack of self-control (654). In such contexts, people living with overweight and obesity experience high levels of discrimination, which may manifest as bullying, being socially ignored or having less access to economic opportunities (654). Overweight and obesity is also associated with low socio-economic status in HICs (655), which differs from African communities where higher body mass is seen to represent wealth and wellbeing. The women in this study described a range of factors that encourage African women to be 'fat', such as the fact that 'African men love fat women':

> Most African men like chubby women, that's a fact. Many of them will prefer to go 'back home' and find their big curvy wives to marry and bring here, unless they can find the big women here (P6).

This quote supports the narrative around African men's preference for plump and curvy female bodies (656-659). The women described popular vocabulary commonly used to describe 'fat' women, which included words like 'thick', phrases like 'big madam' or local slang like 'orobo' meaning excess weight. Men are reported as having a tendency to sexualise these terms, using them to describe parts of women's bodies – especially those they consider 'the right places'. For example, women with big buttocks, breasts, thighs, hips or legs were said to have 'package', described as 'loaded', or said to have 'cargo'. Participants also described women's general reactions towards these slang terms:

> Women actually smile when they call them these names because our men like it, and they say you look like a proper African woman (P3).

While such terms could be seen as derogatory, they are reported as taken for terms of endearment, because African women interpret them as men's admiration of their bodies. In addition, they outlined how men use these terms as a way of likening women to the ideal African female figure, which has historically been perceived to be to be heavier and curvy. These features are so desired that women who don't have them are described by men in some African communities as 'food without salt'. This way of thinking was also reported to influence weight-related behaviours in some African communities, such as force-feeding brides-to-be to 'fatten them up', in order to make them 'more suitable for marriage' and 'more attractive to their husbands'.

Aside from wanting to conform to the idea(l)s of attractiveness of their male partners, having a bigger body size is considered useful in some of the women's communities back home, where strong winds or floods are common. Women described how these weather hazards sometimes destroyed houses and 'could carry people away', meaning that being bigger is seen as an advantage in such circumstances:

> We have this strong wind sometimes and it can last for days. When that time comes, small children or people who are light have to carry stones in their pockets to give them more…extra weight you know. If not the wind can just blow you from one place to another or even carry you away. It's a big problem and sometimes people even get missing. My mother, she always used to tell us when we were growing up that she doesn't have any children to sacrifice (laughs) so she'll remind us of the wind and make us to eat (P17).

In this way, being 'fat' was regarded as a safety measure for such situations. It was also seen as a sign of responsibility, of someone with the ability to care for self and others, as women were expected to be strong enough to protect their children in adverse conditions.

- **Not 'too fat', not 'too small'**

Despite the typical preference for women to be big in size, being 'fat' is only considered 'acceptable' or 'desirable' up to a certain weight limit. Participants outlined that there is a 'normal fatness' that is expected of, or that 'looks good' on, women, and going beyond this weight threshold invites unpleasant comments from others, because 'it shows negligence' (P3) or 'shows she's a glutton' (P8):

> Fat women are beautiful and people will always admire it, except if you're like too fat, before people can say things to mock you (P3).

This tells of a societal classification of degrees of fatness which are socially acceptable, beyond which women may face social stigma. The idea of a normal fatness in the African community was also mentioned in a South African study, where women believed that exceeding this weight limit would make them more susceptible to diseases (660). Participants gave examples of unpleasant words used to describe women who were considered 'too fat', which included descriptions like 'trailers' or 'pigs'. To better understand the size range from which a woman would be considered 'too fat', participants were asked to identify which of the

silhouette images shown in Chapter 7 Figure 25 would be classed as ‘too fat’. Most selected images were in the extreme obese BMI categories. Some participants also described these extreme obesity silhouettes as ‘the start of obesity’. This begins to suggest that African women (or the African community in general) may have a different picture of what unhealthy weight looks like, compared to what’s defined by the scientific community.

Unlike the well-admired big and curvy female figure, small body size in the African culture has traditionally been associated with poor nutrition, disease or low socioeconomic status (661, 662). Stigma relating to smaller body size in the African community appeared to be a bigger issue, as women shared experiences where they or others had been called unpleasant names due to their body size. Examples of these included ‘bony’, ‘dry bones’, ‘no meat’, ‘dry dry’ or ‘bonga fish’. They also described how small body size was often associated with hunger, poverty, misery or neglect:

> When you’re small, they’ll say you look hungry, that you’re like a rope, you’re like a skeleton or they’ll say…you’re suffering. If you’re married, it also shows that your husband is not taking good care of you (P12).

While the obesity literature reports that people with lower income are more vulnerable to obesity, the general thinking in this community is that people who are small in size are more likely to be poor. Small body size is also affiliated with sickness; and significant weight loss is taken to be an indication of the manifestation of disease:

> Maybe they haven’t seen you for some time, then they see you and you look a lot smaller than the way you were, most of the time they just believe you have HIV and you’re dying. They don’t think that someone can just want to lose weight like that (P1).

In this way, deliberate acts of weight loss that aim for a small body size are seen as relatively unthinkable, especially in cultures where excessive weight loss can be a marker for HIV. As a general rule, the health-wealth gradient shows that the richer you are, the healthier you are (663). In the African context, big body size means good health and hence, wealth. This then gives an indication of why the contrary would be seen as ill health or poverty.

Scrambler (664) distinguished enacted stigma which is the experience of discrimination and unfair treatment from others; and felt stigma, which is the fear of enacted stigma. In one of the interviews, a participant shared an experience showing how stigma towards small body size resulted in avoidance of health care environments:

> There was a time I went home from [another country], about four years ago. People noticed I started losing weight a lot and everyone was worried. My father advised me to go to the hospital for check-up, but […] I couldn't go. First of all there were already rumours that I have HIV. And, because you know…it's a small community, if somebody sees me in the hospital, they'll just confirm to everybody that what they said is true. So I knew that if I want people to stop calling me names, I have to put on weight. So I started eating a lot, I took pills for appetite, I…I did everything, and it was working. I added a lot of weight over like 4 months until people now believed that I was fine…I actually had a thyroid problem, I found out later on, because I had gotten really sick. But it wasn't HIV (P14).

Not only did the stigma of weight loss hinder care-seeking (665, 666) but the fear of being suspected to be HIV-positive, and the need to prove that they are healthy, drove this woman to over-eat in order to gain weight. While societal standards of desirable body weight in the African community may be different from other communities (e.g. HICs), the above descriptions show how (low) weight bias may be encouraging of weight gain, hence, fuelling obesity in this community. Being markedly over or under the idea(l)s of 'normal fatness' is stigmatising, and aligned with a broad range of prejudicial perspectives.

8.4.3. Acculturation: towards new weight perceptions

Acculturation is a well-known migration-related concept which refers to the social, psychological and cultural adjustments made by individuals or groups after being exposed to a new culture or society (667). To understand acculturation at group level, it is important to start by looking at behaviours and perceptions before migration, how these changed over time, and the factors that influenced these changes. In the previous section, I described societal views on women's weights in the African context. In this section, I describe how these women's weight perceptions changed after migrating to the UK.

One important consideration to make regarding migrants is that they are a select group of people whose views, values or beliefs may vary systematically from those of their non-migrant counterparts. Hence, their weight preferences may not reflect the ideals of their countries of origin. Participants previously described that the African culture prefers women to be 'thick', but 'not too fat', and not 'too small' in size. However, in relation to their own body sizes, the participants had different views. Half the women in this study believed they had an overweight BMI, while the other half believed they had a recommended weight. Yet, irrespective of perceived weight status, most women expressed the desire to 'lose some weight', showing a high level of dissatisfaction with their current weight status. Women also identified thinner figures (underweight and recommended weight silhouettes - see Chapter 7 Figure 25), as their ideal body sizes. This observation contrasts with the finding that African women living in HICs have a more favourable view of larger body sizes (280-285, 668), and shows that weight perceptions may change upon migration, leading migrants, especially women, to have different body shape or weight preferences. Although a few women in this study indicated that they were 'happy' with their current self-perceived overweight size, this was not common.

The desire to lose weight or preference for thinner body sizes among migrant African women living in the UK may be seen as their adoption of Western ideals of slimness. Western societies like the UK have historically equated a slimmer physique with elegance, social attractiveness

and self-control (669). Participants described various factors related to living in the UK which influenced changes in their weight perceptions:

> Here you learn a lot about why it's not good to be fat. They tell you in the hospital, they show it on the TV and…you read about it in many places (P11).

Living in the UK is reported as contributing to an increased exposure to health messages about the risks of being 'fat'. As a result, the 'bigger is better' idea women have when living 'back home' seems to shift after migration, to one where being 'fat' is thought of as 'not good'. The idea that being fat is 'unhealthy' or 'not good for your health' resonated throughout the discussions as key factors influencing women to become 'more conscious' about their weights, and also driving their desires to lose weight. Being in the UK was also reported as increasing women's knowledge of their BMI, as one participant described:

> When you go to, to see the midwife, first thing is take your weight. Yeah…it was, for me it was my first time to know about my BMI and I was surprised she said I'm a bit, a bit overweight (P2).

She got to know about her BMI for the 'first time' during this interaction, which means prior to migrating to the UK, she hadn't had this knowledge. That she mentions being 'surprised' to hear of her weight being 'a bit' above recommended implies she had a different perception of her weight status at the time. This is an example of weight misperception, where an individual's actual and perceived weight status differ. Other signs of weight misperceptions were identified during the interviews, where some women's verbal descriptions of their perceived body sizes did not correspond with the images they selected to represent their current body sizes. For example, some participants who said they believed they were overweight pointed at obesity silhouettes, stating 'I think I look like this', while others who believed they had a recommended weight showed overweight silhouettes. So, these women may be under-estimating their weights, a finding which is concordant with the literature on African women's weight

perceptions (289, 670-672). This also means that their actual body weights may be higher than what they believe, and, like the participant above, several women may be surprised to find out that their BMIs would be classified as either overweight or obese.

Weight misperceptions can have serious implications on weight and weight-related behaviours, and can hinder the prevention, control, and management of overweight and obesity (285, 672). Some women may even under-estimate their body weights to the extent of thinking that they are underweight and need to gain more weight, as was the case with this participant:

> If I was 'back home' now, like, I will be trying, trying to gain weight (laughs), but here now I know that I'm not skinny like I used to think…so I don't need to eat more, or try to…um…put on more weight (P9).

That she used to think she was 'skinny' before she came to the UK, but now has a different view of her weight status, shows how women's weights are viewed differently in the two societies. She also describes how the idea of being 'skinny' would have influenced her to make efforts to gain weight, but her new weight perception has now eliminated the perceived need to gain weight. Thus, migrating to the UK has influenced her weight regulation efforts, due to her changed weight perception. Having an appropriate weight perception is important, especially among individuals with an overweight or obese BMI, as this can stimulate the need to reduce weight and increases the likelihood of engaging in healthy dietary or PA behaviours as weight control strategies (673-675). On the other hand, not knowing that one's BMI is overweight or obese can prevent women from seeking help or taking action to maintain a healthy body weight.

- **When weight becomes a subject of importance**

Migrating to the UK was also shown to have a positive influence on women's weight-related knowledge in pregnancy. In discussing African women's views about their weights before and after pregnancy, participants believed that African women are usually 'not bothered' or less concerned about their weights, except 'when they are pregnant' or when their body sizes do not conform with societal preferences (e.g. when they believe they are 'too fat'). Most women either believed that a woman's weight status before pregnancy has 'no effect' on her health or were unsure about any health implications:

> I don't think being overweight or obese before you're pregnant can affect in anyway…I'm not sure. I've not heard anything like that (P1).

This participant shows uncertainty around the influence of preconception weight status on maternal health, and also highlights a lack of information on the subject. Similar responses were shared by several participants. Talking about the negative consequences of preconception overweight or obesity on pregnancy, a few women mentioned having 'heard something like that' in the UK. Thus, living in the UK is shown here as enabling women to become aware of this information, although some questioned it, believing that 'it has not been proven'.

The general lack of awareness around the implications of preconception overweight and obesity in this group means that women may not be aware of how their weight-related behaviours during this period may affect their reproductive outcomes. Having an overweight or obese BMI before pregnancy was not considered as important a pregnancy risk as other factors:

> We hear a lot about um…smoking, and ummm alcohol, and…also drugs, taking drugs…because they're very bad for you - for the mother, and also the child. I think they're the most important things that pregnant women should ummm, should be careful about (P2).

This participant seems to determine the riskiness of the different factors based on how often she hears about them and how serious she believes the impacts are. Most women mentioned having heard ‘so much’ about the impacts of having a poor diet, smoking, consuming alcohol and taking drugs during pregnancy; and that these would ‘harm the baby’, ‘can cause you to miscarry’ or ‘make you to have high blood pressure’. Hence, these were believed to be the ‘most important’ risks. While weight status was considered important, it was not seen as a priority. Participants’ perceptions of what they would prioritise as risk factors in pregnancy were also shaped by their knowledge of what is (un)common among African women, as well as their personal experiences:

> I know about smoking, that it’s bad and all that, but you will rarely…errr, rarely find African women smoking. So I will not…I won’t consider that a risk factor. But for something like drinking, it depends…on the individual. Like me for example, I couldn’t stay without alcohol when I was pregnant…and I was fine…I’m fine and my baby is fine. Back home, pregnant women drink all the time and nothing happens, so I won’t say it’s a risk for us (P8).

Here, the idea that smoking is ‘rare’ among African women means they normally would not have to think about it or its impacts when they’re pregnant, which therefore excludes it from their list of priority risks. Meanwhile, because alcohol consumption during pregnancy is ‘very common’ back home, is seen as ‘normal’ behaviour and ‘nothing happens’ as a consequence, pregnant women usually do not worry about the consequences of alcohol consumption in pregnancy. In the same line of thinking, this suggests that weight status would also not be one of their priority risks, since the women had previously established that obesity is ‘rare’ among Africans, and also that it’s ‘normal’ for African women to be ‘fat’. Therefore, like smoking and alcohol consumption, African women may not be too concerned about their weight status before pregnancy; perhaps, until when their body weights become socially unacceptable, or considered ‘too fat’. When discussing overweight and obesity in pregnancy, women tended to

talk more about the physical discomfort of carrying extra weight, and how this would prevent them from moving around or carrying out their day-to-day activities, with less discussions on the health impacts.

- **Migrant interactions and alternative weight-related views**

Migrant interactions with people at their destination countries may be one of the strongest influences on their acculturation outcomes. Migration scholars have documented how migrants' cultures, beliefs and behaviours become adjusted with increasing length of stay in HICs (66, 70, 78, 238). Associating with 'White people' was identified in this study as one of the main factors that changes African women's weight perceptions after migration:

> When you're always around…especially White people, you start to be more careful about gaining too much weight (P10).

Being routinely around 'White people' is reported as having a positive influence on the women's weight perceptions. Women reported experiencing less weight-related stigma, especially towards smaller body sizes, because what would be considered 'too small' or 'skinny' 'back home' was instead described as 'fit' or 'nice' by 'White people'. However, living in a society where body weight was understood in this context introduced a different kind of stigma for some African women, who felt 'uncomfortable' with the 'general notion most people have in the UK, that being fat means you're unhealthy' (P10). This, again, depicts the differences in weight-related views in the two societies the women have lived in, exposing them to different, contradictory, negative stereotypes around body weight.

While migration literature talks about migrant interactions with host country nationals, there has been less focus on migrants' interactions with other populations in destination countries, and how these may influence the acculturation process or outcomes. Some migrants may interact more frequently with other migrants from their own and other countries, especially in

places where migrants live in enclaves. For example, several women in this study described living in areas where there were ‘many Black people’, and would mostly interact with White British or other White people ‘at work’, at institutions of study, or ‘when I’m out shopping’. Being around other Africans in the UK was cited as a factor that ‘can easily influence a woman to become fat’ (P8):

> When you’re always around Black people, it’s very easy for you to keep thinking that a woman should be…big, you know, bulky…and you can easily get fat and be overweight (P10).

This quote shows that it is possible for some migrants to adopt the views or behaviours of other migrants in the host country. Participants shared a general view that the idea that an African woman should be ‘thick and curvy’ is always upheld within African communities, regardless of geographical location. Therefore, even though some migrants’ weight perceptions may change after migration, the cultural ideals of the female body remain preserved to an extent.

Migrating to the UK was mostly described as having a positive influence on women’s weight perceptions. The increased discourse on BMI and body weight after migrating to the UK could be a starting point for healthy weight management among African migrant women. However, the relationship between weight perceptions and behaviours is controversial, as there is also evidence that the perception of having an overweight or obese BMI may act as a deterrent to healthy weight control, as a result of self-blame, guilt or a negative body image (676).

8.4.4. Shifting dietary behaviours after migration

This section describes my findings on dietary acculturation, including the factors that influence changes in the women’s dietary behaviours after migration, and their perceptions of these changes. One of the important adjustments new migrants have to make upon arriving in a HIC

is navigating an entirely different food environment. The Western dietary pattern – characterised by large amounts of processed food, frequent snacking and eating out – represents a stark departure from common food behaviours in the home countries of many migrants. For example, chicken has a cultural importance in most African countries, and is usually eaten on 'special occasions' such as Christmas, weddings, birthdays and other festivals. Chicken is also 'more expensive than fish', which is consumed more frequently. Meanwhile, pizza and burgers are 'not very common', and also 'quite expensive'. Moreover, fast food restaurants are 'quite recent in many Africans countries' and are still considered 'an expensive luxury for most people'.

When describing their eating behaviours after arriving in the UK, participants commonly used the term 'excitement,' relating to having migrated to a place where there is a wide variety of things that were not common in their countries of origin, notably things like chicken, burgers, pizza and sandwiches. One participant recalled being taken 'straight to the chicken and chips shop' from the airport upon arrival in the UK:

> My brother was the one who took me [from the airport]. He had not seen me for five years, we were so, so happy to meet again. He and the wife – I had never met her actually, and one of my cousins, they picked me up and we went to one chicken place in London. Ah it was so good (P13).

She describes visiting a fast food restaurant here as a way of expressing happiness, of reuniting with family members they had not seen for years. Consuming chicken to celebrate important symbolic events conforms with traditional African norms. However, the important change after migration is the frequency of consumption, which becomes much higher. Several women remembered having visited fast food outlets 'almost on a daily basis', and some up to twice a day, within their first few weeks or months of stay in the UK. This shows how what was once considered 'special' now became 'normal'. Women recalled having 'enjoyed' the taste of

chicken and chips, due to the crispy batter it had, which was ‘different’ from the manner in which chicken was normally prepared back home. They also remembered ‘the smell’ from these shops when walking by, which they described as ‘very tempting’. Women cited various factors that influenced them to frequent fast food restaurants, which included: ‘because I was yet to figure out where to buy raw food that I can cook’ (P9) or because they were ‘unable’ to go in search for raw food or ingredients to cook themselves due to the ‘bad weather’:

> I came here around November and the weather was horrible. Horrible! You know when you just came from that hot, nice weather back home…it’s like now you live in a, in a freezer. For me to go out and go to the market or to go and buy food, it was difficult. Walk like 10 or 15 minutes in that cold? I couldn’t. There was one ummm…one chicken and chips shop just opposite my house, many of them even (…), but one that I liked a lot. So, it was easy for me to just jump in there, get my food and jump back out (P8).

This describes an example of the obesogenic environment in the UK, and how the close proximity of fast food outlets to women’s homes contributed to their frequent visits. Similar stories were shared relating to women’s colleges, universities or places of work. While participants also described consuming different kinds of food within the first few weeks or months of arrival in the UK, the dominance of fast foods, and hence, high caloric intake during this period is important to note. This also paints a picture of the weight and pregnancy-related risks these women may face within this time, especially if pregnant.

Participants described how they eventually outgrew their excitement over the abundance of chicken and chips or burgers overtime, as they started trying to decide what types of food they will be buying, cooking and eating. This change was triggered by various factors, including getting ‘tired of junk food’, ‘missing African food’, realising that ‘too much fast food is expensive’ (P1), suddenly gaining ‘a lot of weight’ and getting advice from friends that ‘too much junk food is not good for you’. It is at this point that women start asking questions about

where to shop, what to buy, what to cook and for some, where they can find African food shops or restaurants. The decisions women made during this time were usually influenced by factors like who they associated themselves with, where they lived and who they lived with:

> I came here as a student and I was living with my brother. His wife was always cooking African food so for me I…I didn't really feel like I miss anything. Even though, the African food here does not really taste the same as 'back home' because, you know, there are some…ummm, some spices that you'll never find here (P13).

This example describes a household where traditional African dietary preferences were preserved, meaning they mostly consumed African food, albeit lacking a sense of authenticity given the absence of some ingredients. Although primarily African, this dietary pattern was also characterised by the adoption of some Western foods, usually breakfast items like cereal, sausages, bacon and baked beans; snacks like crisps, chocolate bars and cookies; and beverages like coffee and sweet drinks. Participants also gave examples of fruits they had incorporated into their everyday diets, which were not common in their home countries, such as apples, grapes and strawberries. Many of the women in this study followed this dietary pattern, some describing it in figures, as '70/30', meaning 70% African food and 30% non-African food. Other factors that enabled women to maintain their traditional African food practices included living in cities like London and Birmingham where 'there are many African shops', and associating themselves with other Africans. A major challenge participants noted was that buying African food in the UK was usually 'very expensive', 'more than ten times' the cost in their countries of origin; whereas 'sometimes they don't even have the same taste'. However, they placed value on preserving their ethnic food culture, which they described as very important. To be able to do this, women described how 'most of the time you have to pay for African food to be sent to you from back home' (P2), or 'you carry bags of food and bring here whenever you travel' (P17).

Eating African food was seen as a way of maintaining cultural identity. As Fischler (677) notes, food is not only of physical importance, but is also an integral part of a person's sense of identity. A common phrase women used when talking about preserving their ethnic food culture was 'it's important to always remember your roots' (P8). Expanding on why this was so important to them, women talked about the nostalgic remembrance of 'back home' when eating African food, which also invoked happy memories of being with family and loved ones:

> When you eat African food…especially if you're eating with other people, you remember how you used to eat 'back home' as family, and sometimes it reminds you of some nice stories you know. Sometimes I like to call my mom when I'm eating, and she'll be happy that at least I can still eat the food I like even here (P11).

Preserving African dietary habits is shown here as a way of connecting with family and recollecting fond memories of 'back home'. Some women felt these memories helped to distract them temporarily from the 'harsh' realities or stress they were experiencing in their new living environments.

While women talked about the importance of preserving their African identities, they also talked about the need to feel some form of identification with other groups in their new society, in order to feel like they fit into or belonged in their social circles. The women often described their experiences relating to self-identification and food preferences in a tiered fashion: first as a national of their country of origin (e.g. Nigerian), then as an African, then as a migrant:

> As a Nigerian, you want to stick to your Nigerian food and eat the things you've been taught to eat from childhood. But sometimes…you can't always find the type of food or spices that you know, so you say hmm okay, if I want to change a bit, it's better to try some other African dish or maybe African way of cooking, after all we're all African…we have many similarities with our food. So you say okay, let me try Cameroonian food, my neighbours (laughs)…but

> then you think again, you think of yourself being a foreigner staying in England…you want to also–you want to adapt to the society you're in, because I mean you're probably working or schooling or making friends with people who are not African. How do you socialise with them if you cannot eat together? (P14)

Various factors are addressed in this quote, like the fact that food preferences are learned from childhood, which then become a part of who we are and how we identify ourselves. It also shows how food can be a symbolic cultural artefact that connects people across countries, giving them a way to preserve and express their cultural identity. However, it also shows that food preferences are not static, and can evolve as migrants interact with other ethnic groups and communities. This means that food choices and the circumstances under which they are consumed can be changed to enable people to socialise, eat together or connect with others. Thus, irrespective of personal will to preserve ethnic food practices, there will always be some level of in between-ness as migrant women integrate into their new societies. In another response, a participant describes how she has to make an effort to identify with other people in her social circle:

> You can't really bring them to an African restaurant, you're not sure if they'll even know…talk less of liking anything there. Even if you succeed to convince one or two people to…to try out an African dish, it's only fair that you be open to eat their own food as well. So, whether you like it or not, sometimes you have to go with them. You go to an English restaurant or Italian, or fast food…it's part of socialising. You can't always be the one to choose where to eat, or you can't be picky every time or turn down invites to hang out…that will not look nice of you. (P12).

This response demonstrates the importance of reciprocity when it comes to social relationships, and how there has to be a mutual exchange of actions between people, which sometimes requires self-sacrifice. Hence, the ability to eat what others eat is shown here as

socially enabling for everyday life. This means that the women's dietary practices can become embedded (to varying extents) in the host country culture over time.

In contrast to maintaining a mostly African dietary pattern, other women described following a typically 'British' or 'Western' dietary pattern. Participants cited various reasons that influenced them to 'switch' from eating mostly African food to mostly Western food, which included having mostly White friends, living in predominantly 'White' cities, living in areas where there were no African food shops or markets, deciding to 'try new things' or 'because I've been eating African food my whole life so I wanted a change' (P19). While it was a personal decision for some women to eat non-African food, others described how they found themselves in situations where they had little control over their food after migration. For example, one participant described how she 'had to' eat non-African food because she lived with relatives who had adopted a Western dietary pattern:

> All these lasagne, jacket potato, baked beans…even the way she [her uncle's wife] made pasta was different. They tried to make me like them, but those things are not for me. But I can't really say anything because…well, I'm staying in someone's house and they're kind to take care of me. Until I can work, start working and move to my own house before I could, I can really decide what I like to eat (P9).

Her example demonstrates her relative lack of autonomy to make decisions about her food consumption, as she has little choice but to follow an acculturated dietary pattern. This shows for some migrant women, the decision on what dietary pattern to adopt is made by others, and this can influence their food choices many years after. While some may eventually go back to eating mainly African food, others may not.

Dietary acculturation has largely been described as the 'Westernization' of ethnic diets, leading to an increased consumption of unhealthy foods (678, 679). However, as seen above, it is neither a simple nor linear phenomenon, and can be influenced by factors that go well

beyond ideas about nutrition or health. These data illustrate how ethnic food traditions evolve as these migrant women integrate into their new living environments. It also shows that while some may have the capacity to select and reshape their food preferences as they see fit, the factors influencing these decisions may not always be within their control.

8.4.5. Weight management in pregnancy: actions and support

In this final section, I look at what women consider to be important weight management strategies during pregnancy, their sources of information, what advice or support they received and how these influenced their behaviours. Women generally identified two behaviours as 'very important' during pregnancy, which were diet and PA. Describing their efforts to maintain a healthy weight, women talked about cutting down on junk food, taking walks, drinking 'a lot of water' and substituting unhealthy cravings or snacks with fruits. Participants identified that 'In Africa, when you're pregnant, there's nothing like regulating what you eat' (P9), because 'that's when you're allowed to eat whatever you want' (P13). However, women made mention of some nutritional traditions that prohibit pregnant African women from consuming certain types of food:

> They say if you eat eggs maybe you cannot have children again in the future. Then snails…because the child can be lazy (P3).

Similar cultural taboos have been reported in the literature, including food items like beans, milk, fresh meat or honey (680). Some of these traditions may limit women's intakes of important nutrients required in pregnancy. For example, I showed in Chapter 6 that African migrant women's dietary intakes were deficient in iron, folate and calcium; such nutritional taboos may be contributing to these outcomes. Other common nutrient deficiencies in pregnant African women include zinc, vitamin A and folate (375, 545). These nutrient deficiencies increase their risks of adverse health and pregnancy outcomes, and thus emphasise the importance of nutrient supplements for these women. Meanwhile, most

participants in this study either reported inconsistent or no use of nutrient supplements in their pregnancy, and many were either 'not really sure' why they were being asked to take these supplements, or had forgotten the advice they had been given concerning them.

When talking about their weights in the UK, women described how it's very common to find White women 'watching their weight' or trying to 'watch what they eat', which is different from the African culture where food preferences are mostly driven by taste:

> They read labels on food, they calculate calories…we don't have time for that! We just buy and go. If it tastes good, then it's good. It used to surprise me how people take time to do all those things…but after some time, I, I saw myself doing it. Now I check everything and I'm very careful with what I eat (P2).

Participants identified that by interacting with White people or Black people who were born in the UK, they learnt to pay more attention to what they ate, even during pregnancy. Over time, despite initial puzzlement, some of the women developed the habit of reading labels before buying food as well as calculating the caloric content of food.

Weight-related advice and support received during pregnancy

African migrant women could derive several health benefits from making healthy behavioural changes to prevent overweight and obesity during pregnancy, especially given their increased risks as seen in Chapter 5, and adoption of unhealthy behaviours after migration (Chapter 6). However, there is a gap in the literature on how these women are being supported on having healthy pre-pregnancy weights so that they do not enter pregnancy with overweight or obese BMIs, or how to manage their weights during pregnancy.

The women in my study identified three groups of people as influential sources of pregnancy-related information: midwives, family members and friends. Midwives were recognised as

'helpful' and giving 'important' advice, especially on PA in pregnancy which women found to be 'very useful'. Participants reported that being in the UK exposed them to 'a lot of information' on the importance of PA during pregnancy, as well as on 'different types of exercise to do during pregnancy', which pregnant women 'back home' were unaware of. For example, women previously did not think walking could count as exercise during pregnancy, or that being physically active could be as simple as taking the stairs instead of the lift, or going to work while being pregnant. Learning that walking, taking the stairs or swimming are good forms of exercise during pregnancy was highly valued by the women, mostly because they found these to be 'very simple'. Their appreciation of this information relates to the fact that they came from a society where PA is typically understood as sport or exercise (as outlined in section 7.4.1.), so these activities were not formerly thought of as PA.

The women identified that PA is usually not given much importance during discussions with nurses or midwives in their home countries, so 'many women don't know that it's important to do things to make yourself active when you're pregnant' (P4). Rather, pregnant women are reportedly provided with conflicting and often 'discouraging' advice about PA during pregnancy, by relatives, health providers or cultural beliefs:

> …because we know that pregnancy alone is already stressful…so pregnant women are not supposed to stress. They say that if a pregnant woman is doing a lot of things, like…like bending down to wash things, cleaning the house, sweeping, walking for a long distance, it can cause her to miscarriage or make the baby to come before the time (P14)

Based on their interpretation of stress, which is taken to mean any form of physical exertion or 'anything that can make you tired', pregnant women are discouraged from engaging in any such activities, with the belief that such 'stress' can be harmful to the mother or the baby. Women described how pregnant women are 'pampered' by their relatives, especially mothers, grandmothers or mothers-in-law, who come around to do things for them, like cooking their

meals and doing their household chores, ‘to make sure you don’t stress’. Even in the UK where participants were mostly separated from their families and no longer had the same levels of community support, some women described how their friends or external relatives such as aunties and cousins would ‘take time off work to come over, months before the baby’s arrival, to cook, clean and look after you until after the baby is born’ (P3). Although pregnant women ‘back home’ received less PA-related advice from midwives, participants also described how these midwives would sometimes organise group sessions where they will dance with pregnant women, which they felt was a better approach to encourage women to be active during pregnancy, as compared to the one-to-one sessions they had with midwives in the UK.

Midwives were also identified as a relevant source of diet-related advice in pregnancy. However, women found the amount of dietary advice from midwives to be ‘too much’, requiring ‘a lot of time to process’, and also delivered in formats they considered unsuitable:

> I’m already stressed with my pregnancy so I cannot be asked to read all the long leaflets and, and information that they give. It’s tedious and I don’t have the time (P6).

Providing pregnancy advice through leaflets is shown here as unhelpful, time-consuming and ‘tedious’, which means the information provided therein may not be serving the intended purpose for these women. Most women were unable to remember any specific examples of diet-related advice they received from midwives, and so talk less of what they found useful.

Some women described how they ‘struggled to relate’ with the dietary advice midwives gave them. For example, one participant shared her experience of being advised by the midwife to consume foods that have ‘this or that nutrient’ because ‘they are good for your pregnancy’; but that identifying which of her common meals had these recommended nutrients was a challenge:

> We eat a lot of our local food here, but we don't always know which nutrients they have or what they don't have. When the midwife says eat more…vitamin complex or whatever…I don't know if my eba and egusi soup has that or not (P10).

Eba is a Nigerian staple made from fried grated cassava flour, also known as garri in other African countries. Egusi refers to melon seeds. The participant expresses here, a lack of knowledge around the nutrient content of the food she normally eats, yet, needs to have this knowledge in order to determine the suitability of her food preferences for pregnancy. But also, there are no relatable examples to learn from, because those being provided by midwives of foods to eat or avoid during pregnancy are incongruent with their habitual diets or meals:

> She was saying, I think, like salmon, shark and some cheese…blue cheese or something. I don't eat any of them anyways (P2).

This signifies that the advice being given to these women may not be addressing their actual needs. Participants described receiving dietary counselling, the information provided does not take into account their African or migrant food context.

Nutrition education and counselling in pregnancy aims to improve the health and nutritional status of pregnant women (681), but this can only be effective if such information is person-centered and culturally sensitive. While the information being provided to these women may prove useful for other pregnant women (e.g. non-migrant or non-African women), an alternative, migrant-focused approach may be needed for this group of women. This is especially important in a society like the UK where pregnant women are from varying backgrounds and migrant populations carry a disproportionately higher burden of overweight, obesity and related comorbidities. In the absence of diet-related pregnancy advice suited to the needs of these women, they are less likely to consume foods that promote a healthy weight in pregnancy, or healthy pregnancy outcomes. The lack of such information is perhaps, why the women in this

study tend to rely more on the advice they receive from family members and friends, who, they said, often 'take time to explain what is healthy or unhealthy' for them during pregnancy, taking into account the types of food they normally eat:

> My husband made a list of all the things I always cook – the things we normally eat. Then he did some research and showed me the ones that I should not eat, and the ones that I can eat…or the things I can eat but only in small quantities, like pepper [hot chili] (P11).

The woman in this example is being advised in the context of her dietary preferences, which makes the advice more practical for her. With this approach, she is more likely to identify things she normally eats but should avoid or reduce, as they may have adverse effects on her pregnancy. However, this method is also limiting, as women may not be made aware of other types of food that may be beneficial for them during pregnancy or may be given incorrect information (e.g. limiting hot chillies). Other women described how they found the advice from especially their mothers, sisters and friends, to be 'very helpful' because these were backed by examples from their past experiences, so 'you can understand why they tell you to eat some things or not to eat some things' (P12). Thus, family members and friends were seen as instrumental in shaping women's dietary behaviours in pregnancy.

Family members and friends were also reported as influencing behaviours that promote excess weight gain in pregnancy. Participants described how African women have a tendency to take pregnancy as an 'excuse to over-eat', with plans to lose weight postnatally; and that this habit is influenced by the belief that 'a pregnant woman eats for her and the baby' and that 'babies are always hungry'. Family members and friends are known to advise, encourage or 'sometimes force' pregnant women to eat more than required, 'because they believe that you have to eat for two' (P5). Women described again, how pregnant women are 'pampered' by relatives, who would ensure that they 'always have something to eat' and 'always eat what they like'. In some communities, family members, neighbours and other well-wishers would

cook varieties of food and bring for them on a daily basis. Family members would also go out late at night in search of their craving or ‘cooking at 2am’:

> I was about 7 months. I could smell something so nice coming from my neighbour’s house (laughs)...you know pregnancy (…) this day I got that smell, I wanted the food so bad. I couldn’t resist, so my husband went there and begged the woman for some of her food (laughs) (P8).

This case is typical, albeit somewhat unusual in that it involves the neighbours, but shows how people would ‘do anything possible’ to help satisfy their food cravings. Friends and relatives in the UK would offer to take them out to eat, buy take-away food for them, or ask them what they had cravings for so they could bring. These made it ‘difficult’ for them to ‘resist’ their pregnancy cravings, which were usually for unhealthy food. Women expressed mixed feelings towards these forms of treatment. On the one hand, they enjoyed it because it made them feel ‘loved’, made their pregnancy ‘less difficult’ and ‘easier to cope with’. On the other hand, they admitted that these forms of pampering encouraged unhealthy weight-related behaviours during pregnancy, for example, that it made it difficult to deal with their unhealthy pregnancy cravings, and also made them less physically active - all of which they believed were ‘not good’ for them during pregnancy.

8.5. CHAPTER SUMMARY AND DISCUSSION

In this chapter, I have examined African migrant women’s understanding of overweight and obesity, their perceptions on the associated risks and implications, their weight preferences, weight-related behaviours after migration and the factors influencing their ability to maintain healthy weights in pregnancy. A key distinctive feature between my conceptual framework and other frameworks on weight perceptions (660, 682-684) is that existing models do not take into account the complex interplay between pre-migration and post-migration influences on how individuals may perceive their weights or ability to maintain a healthy weight. The

influence of migration on body weight is well-documented (67, 70, 71), and factors like acculturation, which has been shown in this chapter to influence both women's weight perceptions and weight-related behaviours, is important to consider. In addition, cultural factors play an important role in women's reproductive health, and some of these factors may not be well-understood without understanding the context as it is in their countries oforigin.

Contrary to the dominant view that 'Black' women in HICs have preference for larger body sizes, this chapter showed a cultural shift towards slimmer body sizes after migration. Other studies on African migrant women living in HICs have reported similar observations, with women preferring to be smaller in size (289, 419, 420). These findings support my initial argument that body size preferences may differ between migrants and non-migrants, and that the amalgamation of these groups as 'Black' may mask important differences which could be helpful in identifying at-risk groups and preventing overweight and obesity.

A second key finding from this chapter is that African migrant women's interpretations of overweight and obesity differ from scientific understanding. For example, it is generally believed to be 'common knowledge' that overweight and obesity are medical conditions and risky to one's health. However, participants' descriptions of overweight and obesity had relatively little or nothing to do with one's health. Their discussions on weight status were mostly centred around what looks acceptable or desirable, rather than what's healthy. I also described how these women had different interpretations for the term BMI. While these findings highlight important knowledge gaps relating to the health implications of overweight and obesity, it also shows that people's everyday views can differ markedly from the more nuanced and complex scientific perspectives on health and illness. Studies on obesity have typically explored theories around causes and consequences, with less attention to the layperson's understanding of overweight and obesity (685). Yet, people's beliefs on the causes of overweight and obesity can be influenced by what they think or know about the issue, and how they interpret the risks in light of this knowledge.

Another point worthy of note is the finding that the women in my study do not believe they are at risk of developing overweight and obesity; whereas the statistics show otherwise. This finding could be suggestive of the idea that while the increasing prevalence among African or Black women may have been spoken of, the women themselves may not have been spoken to. There is, however, a possibility that different ethnic groups at the same BMI may have different levels of health risk, and that BMI measurements may reflect differing accumulations of body fat, which may over- or under-estimate true obesity (133, 686, 687). Looking at the history of the BMI, the index was derived based on data from seven Western countries (Finland, Greece, Italy, Japan, the Netherlands, the USA and Yugoslavia) (6, 688). This introduces the question of how culturally-representative BMI thresholds are. So, while involving these women in discussions relating to overweight and obesity may help raise awareness, it is also important to consider whether BMI thresholds have been retrospectively fitted into weight definitions for other ethnic populations.

Lastly, women described how the context of being pregnant 'back home' differs from that in the UK, and how this influences the levels of support they receive in relation to maintaining healthy weights. While women received increased support from health care providers (HCPs) during pregnancy in the UK and became more knowledgeable about the risks of gaining excess weight, they faced challenges with the more individualistic culture where each woman is responsible for her own health and pregnancy, as opposed to the 'we' culture 'back home' where pregnancy and caring for pregnant women is a shared responsibility.

In the next chapter, I describe the women's perceptions about their children's weights, including their views on child overweight, child obesity and their risk factors

CHAPTER 9: AFRICAN MIGRANT WOMEN'S PERCEPTIONS ON CHILD WEIGHT, CHILDHOOD OVERWEIGHT AND OBESITY, AND ASSOCIATED RISK FACTORS

9.1. CHAPTER INTRODUCTION

As primary caregivers, mothers make up an integral part of a child's ecological niche, and play an important role on children's weight status by influencing their food environments, eating behaviours and activity levels (689, 690). The evidence-base on maternal perceptions of child weight status in both White (589, 691-697) and Black (483, 692, 697-699) populations shows that mothers typically under-estimate or misperceive their children's weights, resulting in childhood overweight and obesity being unrecognised. Inaccurate perceptions of child weight, and a lack of awareness of the health risks, have been associated with less concern about childhood overweight and obesity, and a lower likelihood of seeking help or engaging in healthy weight behaviours (589, 694-696, 700). Meanwhile, current literature reports that if mothers are able to identify or acknowledge excess weight gain in their children, and have an understanding of its health consequences, they are more likely to take preventive action against further excess weight gain (695, 701-704). There is also a lack of studies exploring African migrant women's views of healthy or unhealthy child weight and related implications, the sociocultural factors influencing their views, and how these views influence their weight-related behaviours.

This chapter begins with an exploration of women's understanding of a healthy child and how their perceptions influence their eating behaviours in pregnancy. I then go on to explore their preferences relating to their children's weights, their views on childhood overweight and

obesity and the factors they believe to be the associated risks, both in the context of being mothers and migrants.

9.2. DESCRIPTION OF THEMES AND FINDINGS

9.2.1. 'What the baby wants'

Several participants stated that 'every mother wants to have a healthy child'. In fact, the desire to have a healthy child was the main driving factor behind women making active changes to their diets and lifestyles during pregnancy. Women identified, as reported in Chapter 8, that diet and PA are important behaviours they believe can influence their pregnancy outcomes. Participants believed that pregnancy is an important period when 'women should be careful about what they eat' (P1), because 'the baby eats what you eat'. Women described how they avoided eating certain things to enhance the baby's growth and physical appearance, for example, avoiding food that is 'too cold', 'too hot', 'too sweet' or 'too spicy', because 'it can affect the baby's skin colour' or affect their risk of being born with a disease or disability.

Women also described making dietary adjustments to meet what they believed to be the preferences of their unborn babies, even if knowing that these were unhealthy for themselves:

> McDonald's fries was my everyday thing. I couldn't help myself. You're trying not to think about it but your body keeps wanting … and that smell, oh my God … my baby really liked it. When I eat I can feel how he's happy inside (P8).

This participant describes herself struggling to fight this urge, but argues it's what her baby wants – an idea she justifies by describing the baby as 'happy' after she consumes these fries. Several women had similar experiences with other types of food, as evidenced through statements like 'my baby wanted a lot of sugar' (P2), 'my baby loved chocolate' (P15) and 'he loved pizza and coke' (P9). It is interesting to note that, despite having the belief that 'the baby eats what you eat', it is not in their thinking at these moments that consuming these types of

food, which they themselves identified as unhealthy, would also not be good for the baby. Instead, satisfying what they believe to be the baby's needs takes priority. This shows how women position indulging in unhealthy eating behaviours, as against their own volition, because 'it's what the baby likes'.

The women in my sample also made a distinction between their pregnancy cravings in the UK and back home:

> When I was pregnant back home, I always wanted things like fish, egg, fried eggs not boiled, one of our local soup we call pepper soup, then lots of fruits and salad. But here, it was mostly sweet things … cake, biscuit with cream, fudge, ice cream, fizzy drinks … very unhealthy (P12).

She – like many other of my participants – identified that their cravings in the UK were 'more unhealthy' than those back home, one of them pointing out that 'it's even worse here because the things are also very cheap and you can just order and it comes to you' (P4). The most common examples of pregnancy cravings women cited as having in the UK included soda, fast food, 'lots of cheese', chocolates, cakes with 'lots of frosting', sweets and biscuits. Back home, these included meat (especially grilled), fish (grilled or fried), fruits (mostly oranges, mangoes and bananas), fried plantain chips, salad, fried eggs, garri (cassava flour) soaked in cold water and eaten with sugar, and 'calaba chalk' (a soil-like substance also known as edible clay). Common cravings experienced by women both in the UK and 'back home' were ice cubes, ice cream and hot chili pepper. What I find most interesting is the fact that women craved for fruits and vegetables back home, but not in the UK. Secondly, note the dominance of cravings for food with high sugar content in the UK. Although a few women also mentioned craving for biscuits and cakes 'back home' in addition to ice cream, these were not as common. Women described themselves as 'helpless' or 'vulnerable', adding that 'there's nothing you can do about it' (P4) 'because even if you know that these things are not good for

you, you still have to eat them for the baby's sake' (P6). These descriptions show a potential disconnect between the women's knowledge of what's (un)healthy for them during pregnancy and their actual eating behaviours, which could also mean that they may be less likely to think of diet-related advice during pregnancy as relevant. Perhaps, this may be one of the reasons why they could hardly remember any dietary advice provided by HCPs, as seen in Chapter 8. Ultimately, these findings suggest a need for strategies to support these women on how to cope with their pregnancy cravings, taking into consideration, their migrant background and struggles relating to navigating a new food environment.

9.2.2. A healthy child

The women described their idea of a healthy child in terms of physical looks as 'bulky', 'chubby', and 'round' and in terms of what the child does as 'playful and 'jumping up and down'. They also outlined how they felt a healthy child eats, for example, that they will be 'hungry every three to four hours' or 'not refusing food'. For a newborn, they described a healthy baby in terms of weight, which ranged between 4 to 5 Kgs. Note that scientific literature considers a newborn weighing above 4 Kgs as significantly larger than average, known medically as fetal macrosomia (705). It is evident from this description that what the women in this study consider as normal or healthy child weight differs from scientific interpretation. Sharing her views on healthy birthweight, one participant said:

> The average here [in the UK] is like 2 point something or 3 point something, but I think … for me, I think children are different and you cannot really tell because if my child is above that, it … it doesn't mean he's not healthy (P11).

The participant dispels the idea of an average healthy birthweight, her reasoning being that a child's weight is not necessarily a representation of their health. This view was supported by several other women, who believed that 'there's nothing like' an average healthy weight for babies. Notably, child happiness appeared to be a stronger proxy for child health to the women, as evidenced in the following statement:

> As long as I can see that my child is happy and he's not sick, I'm not bothered about his weight (P10).

Her response shows how perceptions of child health can potentially result in childhood overweight or obesity being overlooked, due to the absence of physical signs and symptoms – other than excess weight gain.

9.2.3. 'A child cannot be too fat'; doesn't matter what the midwife says

All the mothers described their children's current weights as 'normal', except for one who thought her child to be 'on the smallish side'. To better understand their definition of 'normal' child weight, the women were shown silhouette images of children in different shapes and sizes (see Chapter 7 Figures 26 and 27) and asked to identify which silhouette was a close representation of their children's current sizes. While some mothers identified silhouettes in the recommended weight range–hence agreeing with their view, others selected silhouettes in the overweight range, suggesting that they may have under-estimated their children's actual weights. Most of the mothers also expressed a desire for their children to 'gain a little more weight' and identified overweight silhouettes as 'ideal' – also referring to these as 'normal' and 'healthy'. When asked to identify which images they believed to be overweight for a child, they mostly pointed at figures in the extremes of obesity, with some adding comments like: 'I'll say big, but not overweight' (P18) and 'I don't think – I won't say any of these children are overweight' (P5). This shows that the women have a different vision of what unhealthy child weight looks like, and that their visual threshold for 'normal' child weight differs from evidence-based ideals of child weight.

When prompted to discuss whether they were at any point concerned that their children may be gaining too much weight, the women outlined that 'most of the time, we are instead always worried that they're not putting on weight the way we want' (P14) or that 'they are losing

weight'. Most women shared the view that regardless of size, 'a child cannot be too fat', because 'children have what we call baby fat' (P8):

> It's baby fat…the child will lose it when he grows. There are many people who were chubby when they were kids–babies, but they're not fat now…when they're big…it's because the baby fat is gone. So you can't be worried that the child is fat or whatever (P3).

As this quote illustrates, mothers would normally not be worried about having a big baby, because they believe the 'baby fat' would eventually go away. They held strongly to this viewpoint, especially as it was supported by 'proof' of people they knew or had seen in their communities, who used to be 'very chubby as kids' but grew up to be 'normal [weight] adults'. Some of the women used themselves as examples to further support their view, one of them stating: 'If I show you a picture of me when I was a child, you won't believe…I was a fat kid. But see me now…' (P6).

Participants cited various 'energy-demanding' activities through which they believed babies lose their 'baby fat' as they grow, which included crawling, learning to walk and playing. They added that because 'babies change very quickly within the first few months or years' (P10), it's 'impossible' to predict how they will look like in the future. So, while current literature finds that weight status in childhood is a significant predictor of adult weight (706, 707), the women clearly think differently. They feel that it's only in a 'few cases' that a child looks the same (in terms of size) at adult age as they did in childhood. Women believed that where childhood overweight progressed into adult age, this would usually be 'because of their genes' or as a result of 'other things the person is doing that is making them fat' (P11). These descriptions echo the women's responses in the previous chapter, where they identified genetic susceptibility and decisions made at an individual level as some of the main causes of overweight and obesity.

One participant revealed by describing her personal experience, how her strong belief in the 'baby fat' idea led her to disregard advice given by her midwife for her son, who she acknowledged was 'quite a big baby':

> People were saying "oh he's big, oh he's that" … and my midwife said "his weight is up—above the charts"…she was trying to tell me how I should adjust his diet (…) but I didn't do all of that because I knew, I knew that he's just a baby, and the baby fat will go away. If you see him now, when I show his baby pictures to people they don't believe. He's two and a half now—almost three, and all the weight is gone' (P12).

It can be seen from this description how this woman's beliefs are reinforced, for example by the fact that her son eventually lost weight (according to the woman's narrations) as she had anticipated. Hence, it is little surprise that several other mothers would think and/or behave alike. These findings raise an important issue – if mothers continue to ignore weight-related information given by health providers for their babies whose weights are identified as above average, what happens if this 'baby fat' doesn't go away eventually? This poses a risk for some children who may accumulate this excess body fat in childhood, potentially leading to overweight and obesity at adult age. The findings also highlight a need to enable these women to recognise when their children's weights are cause for concern, and when action needs to be taken.

Despite the view that 'a child cannot be too fat', participants acknowledged that childhood overweight and obesity do exist, but only from a certain age:

> I think from six months because that's when…well most of us, we want to start giving real food and sometimes if it's too much then yeah, the baby can be overweight (P1).

Overweight and obesity in childhood were linked to 'real', adult, food, as the participant described, often as a result of over-feeding. Other age ranges cited included nine months, 'when a child starts walking', and 'school age'. These time points were cited because 'that's when you can really start seeing how they're growing' (P16) and 'you can compare how the child grows with other children' (P12). The mothers gave examples of when they may be concerned about their children's weights, like 'if they're not very active' or 'if he's not playing like other kids' (P2). However, some participants contended that 'all children are different' and so 'just because he's growing bigger than other children or he's not playing like the other ones does not mean he has a weight problem' (P9). The women also described how their views on child weight would differ from those of people 'back home':

> Let me first say this, if my mom was here and you mentioned a child being overweight, she would have a serious problem with you (laughs)…but I think when a child has reached a certain age, like when they start going to school, then yes, they can be overweight (P7).

This quote suggests that while these women believe a child's weight can be considered overweight at some point, the common belief in their communities 'back home' is that a child cannot be 'too fat' at any point in time.

The question on whether a child whose weight is considered overweight in the UK would be considered the same in their home countries was usually met by amusement, with one participant stating 'that's basically a healthy child'; and another exclaiming 'Overweight? Oh God no! (laughs). African babies are really chubby and they see them as very healthy' (P9). Participants added that the discourse on child weight in their home countries is usually centred around underweight, including in health settings, so health providers are more likely to 'talk about a child's weight if he's too small, like underweight' (P12), and 'you will rarely hear a Doctor saying that your child is too fat, unless if the child is very obese or something' (P5). In addition, participants identified differences in societal reactions towards childhood overweight:

> If a child looks fat, people will mostly give you [the mother] compliments, about how you're…you're feeding him well, he's eating errr…good things, nice things and all that. But here it's different, you know, the midwife will comment, some people will look at you—like, look at you badly, like you're overfeeding the child (P8).

This quote shows societal appreciation for childhood overweight in their countries of origin, and how this is taken as a clear sign of good care by the parent, whereas it is the reverse in the UK. In another quote, a participant described how child obesity appears to be considered a minor health problem in their countries of origin:

> Even when the child is obese, it's not really taken like a big issue, like here. Back there they can just say you should tell him to play more or something but not in a serious tone (P2).

She identifies a difference between how childhood obesity is addressed 'back home' compared to the UK, where 'they will tell you to change his diet, they will check his weight regularly, and many other things for you to know that it's serious' (P12). However, despite getting dietary advice from HCPs, participants' relied more on their own views about their children's weights and how to address the issue. For example, women described infancy and early childhood as a window of opportunity for mothers to ensure that their babies are well-fed, because 'that is the only time when they depend on you for everything—for the feeding, the type of food, so you have to make sure they eat well' (P2):

> The funny thing is, he doesn't even eat anymore…you see? He refuses everything – I have to beg him, force him, to eat. That's why it's important to feed a baby well. Make him eat enough. Just imagine…if I wasn't feeding him well when he was a baby, he will surely be like a broom now (laughs) (P10).

This shows how some mothers may adopt early infant feeding practices that could contribute to childhood overweight and obesity, out of fear that their babies may grow into fussy eaters or have changes in appetite as they grow. Participants also described feeling 'frustrated' that HCPs 'exaggerate sometimes' when advising them about their children's weights, especially

because to them [the mothers], their children were 'happy and healthy'. This view and feeling could be another reason why women may disregard HCP advice relating to child weight, like they did with advise on their own weights as described in Chapter 8.

9.2.4. Infant feeding as a balancing act

The women also described their experiences relating to infant feeding in the UK as a balancing act – balancing between two cultures and two distinct styles in child upbringing. On the one hand, they would like their children to retain their cultural practices – 'especially when it comes to food' (P17); but on the other hand, it's their duty as parents to facilitate their children's integration into the new culture into which they were born. The women distinguished between the 'we' culture in which they used to live 'back home' and the 'I' culture in which they now live, outlining the importance of having other family members around to support them in their daily child care activities, and how these can influence their infant feeding decisions:

> There's this proverb that–I don't know if you know it, they say it takes a village to raise a child. You see, back home, that's how it is. You have other people…there are people that take part in taking care of the children…especially when they're still very small, so it's easy to look after them, and do other things. But here, you're on your own, you're busy, child care is expensive, […] so sometimes you're giving the children something that you know is not healthy, but you just have to do it (P14).

The participant highlights two key issues here – first, the importance of social support in child up-bringing and how it can be enabling for healthy infant feeding. Secondly, how the lack of this support – as a result of changes to the family dynamic after migration – amidst their busy schedules in the UK, may result in poor infant feeding, despite them having knowledge of what's (un)healthy for their children.

The discussion of how mothers feed their babies is usually central to the discourse on childhood overweight and obesity. All the women in this study had heard the ‘breast is best’ adage, and most knew that breastfeeding is ‘better than bottle-feeding’ for their baby. In their home countries, breastfeeding is referred to as 'normal' or the 'natural' way to feed a baby, while bottle-feeding is seen as 'unnatural' or 'controversial'. However, several of the women decided to bottle-feed after migration – a decision which had ‘nothing to do’ with their own weight:

> I don’t think your weight has anything to do with whether you choose to breastfeed or not. It’s all about what works for you. I don’t see how my weight can stop me from breastfeeding if I want to (P4).

Current literature finds that maternal overweight and obesity correlate negatively with the intention or ability to breastfeed (189, 199). However, the women do not see any association between their weight status and infant feeding decision. They cited other factors they believe to be more influential in their infant feeding decisions, such as time, having to work and ‘whether the baby will accept to breastfeed’ (P1). They also discussed factors they believed were enablers for women ‘back home’ to breastfeed – hence the high breastfeeding rates ‘back home’ compared to the UK - such as the positive support for breastfeeding in the community, and fact that ‘bottle milk is expensive for the average woman’ (P20). The literature on infant feeding also states that breastmilk is protective over child obesity, especially if done exclusively in the first six months as recommended by the WHO (191, 708, 709). Most women however disagreed with this view, believing that ‘there’s no big difference’ between breast and bottle milk, several of them stating having tried the ‘exclusive breastfeeding thing’ but seeing ‘no difference’ in their children’s weights. Hence, contrary to scientific knowledge, maternal weight status was not seen as a determinant of infant feeding decisions or practices.

Relating to maternal weight being a determinant of childhood overweight or obesity, the women believed that their weight status – whether before or during pregnancy – has ‘nothing

to do' with a child's weight. Most women were of the opinion that a mother's weight status can only be an influence on her child's weight after pregnancy and through over-feeding:

> When you're too fat, you eat a lot, because you're always hungry. So you can also feed the child too much because you're thinking that the child is always hungry like you (P6).

Many women identified over-feeding as the sole or biggest cause of childhood overweight and obesity, and the 'only way' a child's weight status can be linked to maternal weight. Very few mothers believed that their child's weight could be influenced by their weight status in pregnancy, and the source of this knowledge was either the women's careers or academic studies which were related to health. So, while current literature identifies maternal weight status as a significant determinant of child weight, the women think differently.

- **Treats and quick fixes**

In line with their efforts to blend 'back home' and UK behaviours relating to child-upbringing, participants discussed the 'new' habit of using food items and electronic devices as quick solutions to enable their everyday living — new in the sense that these behaviours were 'not common' in their countries of origin. For example:

> There are times when you just need them to sit down in one corner and be quiet. You need some peace, even just for an hour so that you can rest … so I give the tablet and some sweets or biscuits so that they can leave me alone (P19).

In another example, a mother describes how she uses similar items to compensate for the child being lonely or being away from loved ones:

> …because he doesn't have anyone to talk or play with … most of the time it's just the two of you, if it's a single child. I don't want him to feel bad, like the times when we just came back from Africa on holiday, or any place where he had people around, now it's just two of us again and mummy can't play all the time…so he's lonely (P21).

Here, the participant identifies a need to keep the child entertained as a result of the absence of other family members or play mates; also outlining how she as the mother is unable to fill this gap as she is busy with other household or motherly duties. She continues by recounting how her quick fix comes into play:

> …every child has something that they like, my son he likes to play on my phone, and also having his gummy bears and juice–soft drink. When I give him, that's it, he's fine. He won't be thinking of anything again and that look on his face just goes away (P21).

This quote shows how the mother uses her knowledge of what the child loves to keep him satisfied; which also reiterates the point made earlier, that mothers aim to satisfy their children's wants to keep them happy, since 'a happy child is a healthy child'. Women described several other scenarios where these treats and quick fixes were used, such as to show love, to show appreciation, to reward them for good behaviour, to keep children entertained, to soothe them when they cry, to calm them down, to distract them so the mother can work, study, do household chores or attend to visitors, or to keep them quiet so the mother can rest or sleep. These examples show that the adopted behaviour of giving children snacks (mostly with high salt or sugar content, such as sweets, crisps, biscuits, cookies, chocolates, sweet drinks) and electronic devices (phones, tablets and video games) became a part of their everyday lives. We can also begin to see how these behaviours can influence children's diets and activity levels.

Comparing these behaviours to common practices 'back home', participants outlined how these scenarios would be handled differently:

> If it was back home, there's only one thing you need to do, just let the children go outside and play. That's all. Problem solved! (P14)

Women described how their living environment ‘back home’ differed from that in the UK where ‘it’s very rare’ to see children out playing by themselves, especially since ‘most of the time you don’t even know your neighbours’ (P1), and ‘parents would freak out’ if their children stepped outside the house unaccompanied. Meanwhile, back home, letting children go outside to play with other children was seen as ‘very common’, ‘very normal’ and something most children desired and enjoyed. In fact, women described how mothers ‘back home’ get their children to do things like finishing their food, taking a nap, doing their homework, doing light household tasks or generally being of good behaviour by promising to let them go outside and play. Whereas in the UK, ‘most of the time you have to try every way you can to keep them entertained inside the house’ (P20). Participants added that although children ‘back home’ were also given treats like yoghurts, cakes, biscuits and sweets, this occurred less often than in the UK.

In conclusion, women identified living in the UK as making their children more susceptible to overweight and obesity compared to children back home, admitting that ‘we also play a part’ because ‘we want to give them the best, but it’s not always good for them’ (P11). However, the women believed that overweight and obesity are not as common in African children as they are in White children – ‘especially British children’, or ‘children whose parents grew up here and have adopted the British system’ (P19). Childhood overweight or obesity is therefore not a primary concern for them when it comes to their children’s health.

9.3. CHAPTER SUMMARY AND DISCUSSION

In this chapter, I have described the women’s perceptions of their children’s weights, and their ideologies around the risks of childhood overweight and obesity. Studies on maternal perceptions of child weight have typically focused on quantifying and determining predictors of accurate child weight status (589, 691-696), with little being documented about women’s

interpretations of child weight status, (un)healthy child weight and the sociocultural factors surrounding their views.

This chapter outlined the key role that pregnancy cravings play on women's eating behaviours, and their interpretations of these urges. Pregnancy cravings are common among pregnant women, may manifest at any stage of pregnancy and have been shown to be challenging for most women (710-713). These may be even more difficult for migrant women who are still trying to navigate a new food environment, especially one where there is an abundance of cheap and unhealthy food. These findings identify a need for support that goes beyond clinical care and addresses these women's specific cultural and psychosocial needs, which is an area I found lacking in the literature.

The 'baby fat' idea discussed in this chapter is akin to what has been referred to as 'puppy fat' in other studies (701, 714-716) – typically in older children, referring to body fat which supposedly disappears as children grow taller and their body shape changes. There has been some debate about whether or not these are myths, and how parents can tell the difference between this 'baby fat' or 'puppy fat' and actual child overweight or obesity (717- 720). In a UK study (721) that tracked the weight status of over 5000 school children over five years, it was seen that children who started secondary school with higher weights continued with this trend throughout until they left. An Australian study (722) showed similar findings, where children who had excess weights in primary school were still carrying this excess weight in later high school. It was therefore recommended that the 'puppy fat' idea be abandoned (721). Meanwhile, under the National Health service (NHS) guidance on obesity in children (723), it is advised that parents use their 'common sense' despite the 'scary statistics heard in the news', as 'most children are prone to having some 'puppy fat' which will usually disappear as they get older and their bodies stretch and grow'. Such conflicting pieces of advice may be contributing to parents finding it challenging to identify childhood overweight or obesity.

To my knowledge, no published study has explored the 'baby fat' idea in the African population, or its implications on maternal weight-related behaviours or infant feeding practices. This is an important area to explore, especially since children of African migrants are shown to have a higher risk of childhood overweight and obesity, as seen in Chapter 5.

The UK provides child weight management support for parents through various ways, such as school height and weight checks where parents are informed if their children's weights are seen to be overweight or obese (724), NHS advice on weight management centred around diet, physical activity, reducing screen time and parents being role models for their children (725); and the Mind, Exercise, Nutrition, Do it! (MEND) programme which helps families change unhealthy attitudes about food, PA and general lifestyle (726). Making use of such programmes require that parents be concerned about their children's weights, and willing to take action. Meanwhile, the participants in this study generally showed less concern for child overweight or obesity, which is also a common finding in other studies (694, 714, 727, 728). So, while there is available support on what parents can do to help their children attain a healthy weight, there may not be enough support on why they should be interested in this in the first place. It is important to identify reasons why mothers may be reluctant to acknowledge child overweight or obesity, such as why women feel that HCPs 'exaggerate' when advising about child weight, which makes them 'frustrated', as seen in this chapter and also reported in other studies (729, 730).

Several times women made reference to child happiness when describing their views around child weight and health, which echoes previous findings showing less maternal concern for child overweight or obesity if children were otherwise considered to be happy and healthy (714, 727, 728). Perhaps, it could be more helpful for mothers if interventions aimed at promoting healthy weight-related behaviours both for mothers during pregnancy and for their children were centred around child happiness, rather than child weight. For example,

embedding an understanding of child happiness and overall wellbeing in overweight and obesity prevention messages. Such strategies may also prompt women to give more thought to their children's weights during pregnancy, especially as they revealed during interviews that child weight (especially child overweight) is not one of the things they think of or worry about during pregnancy.

Women's views relating to maternal weight status as a determinant of breastfeeding intention, ability or duration were incongruent with what's reported in the literature. Their views are supported by findings from an American study which found that maternal pre-pregnancy BMI was neither associated with infant feeding pattern nor with breastfeeding duration or exclusivity among Black women (731). While breastfeeding rates were low among Black women in that study, they were still higher compared to women from other ethnic groups, but showed no association with maternal weight. Possibly, Black women may be less affected at the same BMI level than White women in their ability to breastfeed, just as differences in other outcomes have been reported between Black and White women, like number of lives lost as a result of obesity (732). Perhaps, maternal weight status has a different biological influence on Black women's breastfeeding ability or success compared to other women, as a result of differences in their knowledge of breastfeeding, commitment to breastfeed, confidence in their ability to breastfeed, or other characteristics not explained by biological factors.

What's most important is not whether these women's perceptions are 'right' or 'wrong', but that their lay reasoning is different from current epidemiological knowledge, and these differences may be missed if health-related concepts are always viewed from a medical evidence-base. Studies have shown that medical literature is often flawed by a failure to account for sex differences (733) or social factors (734) in the generation of evidence. Further exploration into women's perceptions would help in understanding the link between maternal nutrition in pregnancy, maternal and child weight status and weight-related behaviours. It is also important to consider the implications of these on women's attitudes towards advice

provided by HCPs, such as the disregard for HCP advice relating to child weight as shown in this chapter. Understanding these factors, in addition to identifying who these women are more likely to listen to or take advice from, could help inform the development of inclusive and culturally-tailored interventions to help support healthy weight management in both African migrant women and their children.

CHAPTER 10: THESIS DISCUSSION

10.1. CHAPTER INTRODUCTION

This thesis had two overarching aims: the first was to synthesize the available literature on the prevalence and determinants of overweight and obesity among African migrant women and children living in HICs. The second aim was to explore UK-based African migrant women's perceptions on women and children's weights, their weight-related behaviours and their perceived risks of overweight and obesity to themselves and their children.

Chapter 1 provided a background on obesity as a public health challenge, and an overview of my population of interest. In chapter 2, I reviewed the literature on the prevalence and implications of overweight and obesity in women of child-bearing age and in children, including the role of migration on body weight and weight perceptions. Chapter 2 also identified knowledge gaps relating to overweight and obesity in African migrant women and children, outlining how they informed my study aims and objectives. Chapter 3 described the methodological approaches used during this research, and their philosophical foundations. In chapters 4-6, I synthesised the evidence on the prevalence of overweight and obesity in African migrant women and children, including factors associated with these outcomes. Chapters 7-9 explored weight and obesity-related perceptions of African migrant women living in the UK. In this chapter, I discuss the main findings as they relate to each of my research aims, drawing on and integrating them with current literature, and describing their theoretical and practical implications. I also outline the strengths and limitations of this research and make recommendations for future research, policy and practice.

10.2. SUMMARY OF MAIN FINDINGS

10.2.1. Overweight and obesity in African migrant women and children

This thesis showed evidence that African migrant women living in HICs had higher mean BMIs and higher odds of overweight and obesity compared to non-African women from HICs (see Chapter 5). Taking the women's pregnancy status into account, both pregnant and non-pregnant African migrant women had significantly higher mean BMI and odds of overweight than non-African women, but not obesity. Non-pregnant African women also had significantly higher odds of combined overweight/obesity compared to non-pregnant non-African women. These findings support the overall evidence that women from African backgrounds in HICs have a higher prevalence of overweight and obesity compared to non-African populations (278, 332, 344, 345). In line with current evidence on the implications of overweight and obesity (see Chapter 2 section 2.5.), these women are predisposed to further health risks and poor pregnancy outcomes. Maternal weight status is also a significant determinant of child weight (as described in Chapter 2), which means that these women's children are at risk of developing childhood overweight and obesity, as well as other obesity-related complications. My findings on child weight showed higher mean birthweights and higher odds of overweight, obesity and macrosomia in children of African migrant women compared to children of non-African women from HICs. These findings are also consistent with the evidence that children from African backgrounds in HICs have a higher prevalence of overweight and obesity compared to non-African children (278, 332, 344, 345).

Being macrosomic at birth predisposes children to other health problems after birth such as type 2 diabetes, metabolic syndrome, autism and some cancers (737, 738). Fetal macrosomia is also a well-known predictor of overweight and obesity in childhood, as well as at later adult age (735, 736). It may also cause complications for women during delivery, including emergency caesarean delivery, shoulder dystocia and trauma to the birth canal (738, 739). This puts children at risk of injury during child birth (738, 739).

My findings on LBW showed lower odds in African children compared to non-African children (Chapter 5). Current evidence on the association between LBW and childhood overweight/obesity shows mixed results – some studies report a decreased risk of overweight and obesity for children with LBWs (740-742), while others have found that children with LBWs tend to have higher catch-up growth rates in infancy, which increases their risk of developing obesity later in childhood (707, 743, 744). High catch-up growth rates were seen in one of the studies included in my reviews – children of African migrant women were smaller at birth compared to French children, but caught up with them by one month of age, and at six months, their weights were significantly higher than those of French children (468). Possible factors that may influence rapid weight gain in infancy leading to overweight and obesity include child nutrition and environmental factors (745). In addition to the associated risk with obesity, the Barker hypothesis establishes a causal relationship between LBW and chronic diseases in later life, such as cardiovascular disease, hypertension, stroke and coronary heart disease (746). This highlights the importance of preventing LBW in children, although other variables such as environmental exposures and behavioural factors (e.g. dietary patterns and PA) also play mediating roles.

This thesis also found important differences in weight outcomes based on what region of Africa the women had migrated from. For example, North African women had significantly higher odds of combined overweight/obesity compared to non-African women, while women from SSA had non-significant results. North African women also had significantly higher mean BMI and odds of overweight and obesity compared to non-African women, with the results being higher than seen in the overall analyses (see Chapter 5 Table 9). There was insufficient data to make similar comparisons for women from SSA. However, a majority of the studies that were excluded from the meta-analyses reported on women from SSA, and most of these studies showed a high prevalence of overweight and obesity among these women.

In children, regional differences were seen for mean birthweight and macrosomia – children of North African women had significantly higher mean birthweight and odds of macrosomia compared to children of non-African women, while results were non-significant for children from SSA (Chapter 5 Table 10). The odds of child obesity and combined child overweight/obesity in North African children were also higher than seen in the overall analyses.

These findings show that in addition to migrant status, there are other dimensions to health inequities across migrant populations, and combining heterogeneous groups may mask important risks pertinent to specific population sub-groups. It is quite common to find studies combining heterogeneous populations (e.g. migrant and non-migrant Blacks in HICs), and this often involves several generalisations, usually for the sake of factors like sample size (91). Findings from such studies may not be reflective of actual weight (or other health) outcomes in the different populations, and may lead to some population-specific health risks not being identified. Further understanding of ethnic disparities in the prevalence of overweight and obesity in HICs – especially in populations identified to be at higher risk – may be best served by recognising these differences both during data collection and intervention planning. The WHO emphasised in a recent technical report (221) that migrants' health profiles are a reflection of both their medical histories and the burden of disease and quality of care in their countries of origin; so country of origin, rather than just migrant status should be considered a risk marker for screening, obstetric history and general health status.

I also made some comparisons between the weight status of African migrant women and children living in HICs, and those of women and children living in Africa (Chapter 5). My findings showed significantly higher mean BMI for African migrant women in HICs than that for women living in Africa (Chapter 5). These findings support the evidence associating migration and increased body weight (66). There were however, limited data to assess post-migration changes in African women's weights over time, as very few studies compared their

current BMI with their pre-migration (or on-arrival) weight status. Further research would be useful in understanding trends in African migrant women's weight status after migration, as well as factors influencing these.

Chapter 5 also showed a higher prevalence of overweight/obesity among African children living in HICs (range 21-44%) compared to estimates from studies in various African countries (all less than 20%) (747-750). Studies have reported various environmental factors in HICs that influence child weight, such as screen time, sleep duration, dietary and PA behaviours as well as parental influences on child nutrition and PA (510, 511, 518, 519). Maternal influences on child nutrition and weight-related behaviours were described in Chapter 8, where women reported adopting the habit of giving their children energy-dense snacks as treats, and also promoting their use of electronic devices. It was also identified that African children engage less in outdoor play activities in the UK, as compared to back home. These findings shed light on how HIC environments and behavioural adaptations after migration can influence children's weights. There were also some data limitations relating to child weight – it was not possible to compare the findings on birthweight from this thesis with findings from African countries due to lack of data. According to UNICEF, nearly 75% of newborns in Africa are not weighed, which is also common in other low-income countries (751).

10.2.2. Determinants of overweight and obesity in African migrant women

The literature on migration and obesity associates increased weight status after migration with the adoption of unhealthy weight-related behaviours, usually as migrants get immersed into the HIC environment and culture over time (67, 70, 71, 225, 752). In Chapter 6, I described some of these unhealthy behaviours adopted by African migrant women, which included increased consumption of food with high salt, high sugar and high fat content, increased snacking and more frequent out-of-home eating. These factors are all shown to be associated with an increased risk of obesity (13, 70, 97). Chapters 6 and 8 also provided insights into

factors that influence these behavioural changes. The food environment in HICs – especially the abundance of cheap unhealthy food – was one of the biggest drivers of dietary change, leading to an increased consumption of energy-dense foods. Other environmental factors such as built environments in HICs, transportation systems, work environments, social environments and the weather were also shown to have negative influences on women's PA levels. These findings are in line with the evidence on acculturation and weight status, showing that migrants tend to adopt less healthy behaviours after migration (67, 70, 71).

Looking from another perspective however, there is a possibility that the process of 'Westernisation', or changing to 'Western' dietary and PA behaviours could have started before migration, due to the nutrition transition occurring in LMICs (753). The nutrition transition is characterised by urbanisation and a shift from less energy dense diets and more active lifestyles to a higher consumption of fatty foods and sedentary lifestyles (753). My study participants recognised in Chapter 8 that 'things are changing' in many African countries, with many areas, especially urban towns and cities becoming 'more like developed countries'. These changes come with an increase in fast food outlets, increased convenience and snack foods, and increased sedentary lifestyles (753-755). Thus, the high BMI seen in some African migrant women may not only be a result of acculturation after migration, but also a reflection of body weights in their countries of origin; in which case, their risks of overweight and obesity, and for their children, may exacerbated after migrating to HICs. This could be the situation especially for women from North Africa, where the prevalence of overweight and obesity is reportedly higher than in other African regions (104). Again, this provides another reason why it is important to know where women have migrated from, as this information can give an idea on the risk profiles of populations in their countries of origin, as well as associated risk factors for overweight and obesity.

While migration studies predominantly report negative influences of acculturation on women's weights and weight-related behaviours, I also found that migration had some positive

influences on African migrant women's weight-related behaviours. For example, women reported increasing their consumption of fruits and vegetables after migration (Chapters 6 and 8), and also developing the habit of paying more attention to the caloric content of food before purchasing or eating (Chapter 8). Similar observations were made in a study conducted in Belgium (756), which showed that alongside the adoption of unhealthy behaviours, being exposed to the HIC culture resulted in an increase in nutrition knowledge and the adoption of healthier eating behaviours among migrants. There were also positive influences on African migrant women's weight perceptions, as shown in Chapter 8. Migrating to the UK increased their exposure to health messages on overweight and obesity, so they became more aware of the risks of excess weight gain. Women also became more knowledgeable about the positive impacts of PA in pregnancy, as well as types of PA suitable for pregnant women; and they were able to recognise some of their previous cultural beliefs and practices as 'unhealthy' (e.g. those promoting weight gain in women).

To my knowledge, no study has explored the positive influences of acculturation on African migrant women, and it is unclear how degrees of engagement in and adoption of HIC cultures are associated with their behaviours or weight perceptions. One important implication of the positive influences outlined above is the fact that unlike before migration where most women desired bigger body sizes, their preferences had shifted to them desiring to be smaller (as seen in Chapter 8). In their countries of origin, it is generally believed that a woman should be 'thick' and 'curvy', and these perceptions are largely driven by sociocultural definitions of an ideal African woman, and stigma affiliated with having a smaller body size. Meanwhile, in the UK, women's weight perceptions were influenced by societal preference for slim women, interactions with other women who desired smaller body sizes and increased exposure to health messages about the dangers of excess weight gain. Further studies on acculturation patterns and their associated influences would be useful to identify factors that can facilitate the adoption of healthy weight-related behaviours among migrants, and possibly how to encourage these.

10.2.3. Perceptions on overweight and obesity in women and children

Two main findings relating to perceptions of overweight and obesity from this thesis were: the belief that obesity is not a problem for Africans, and that neither they nor their children are at risk. The women also had poor understanding of BMI, and there was evidence of weight under-estimation, where women's thresholds for 'normal' or 'healthy' weights were higher than those defined by mainstream literature. Relating to pregnancy, weight awareness only begins or becomes heightened during pregnancy (as described by the sample of women in this study), and they believe that their weight status before pregnancy has no impact on their health.

On child weight, this thesis showed how children of African migrant women are exposed to obesogenic risk factors at multiple levels which include (i) the women's perceptions of child weight which favour excess weight gain (and hence, behaviours leading to this); (ii) socio-cultural influences on the women's behaviours leading to poor nutrition in pregnancy; (iii) both personal and environmental influences on infant feeding behaviours resulting in the lack of breastfeeding, increased consumption of sugar sweetened beverages in childhood, reduced PA; and the belief that a mother's weight status has no influence on her child's weight or her choice of infant feeding method.

Taken in isolation, these findings may be interpreted as suggesting a need for interventions aimed at increasing awareness of what recommended weight, overweight and obesity in women and children look like, and on the risks of overweight and obesity for women and children. However, it is important to recognise that overweight or even obesity are not universally understood as unhealthy. We saw an example of this in Chapter 8, where participants stated that a child who is considered to have obesity in the UK is 'basically a healthy child' back home. Another example is how children of African migrant women were shown to have a significantly high risk of macrosomia (birthweight >4Kgs) in Chapter 5, which has health implications. Meanwhile, in Chapter 9, the women described their idea of a healthy

baby to be in the range of 4 to 5 Kgs. These findings simply show that there are cultural differences in the definition or understanding of different weight categories, and that different cultures have distinct systems of health beliefs which drive their understanding of what counts as illness, what causes illness, how it can be prevented or treated, and also who should be involved in the process.

10.2.4. Nutrition and weight management in pregnancy

This thesis has identified several factors that influence African migrant women's weights during pregnancy. Similar to other studies (757-760), barriers and enablers for healthy eating and PA included factors like beliefs around healthy eating, the food environment, the meaning of PA, perceived benefits of PA and social networks. Women's dietary behaviours in pregnancy were also driven by the health-related desires they had for the unborn child – mostly reducing intake of certain types of food for the baby's health and increasing intake of others to satisfy their cravings. Interestingly, these were in conflict; that is, the types of food women cited as trying to avoid during pregnancy (e.g. sweet, spicy or cold food) were also the types of food they found themselves craving for (see Chapter 8). The fact that these are happening simultaneously highlight an important challenge these women face with their dietary intakes during pregnancy.

There are various guides in the UK providing advice for pregnant women on what kinds of food to eat and in what proportions, in order to have a healthy and balanced diet. Examples of these are the Eat Well Guide and Start4life nutrition recommendations developed by the NHS (761). One of the recommendations is that starchy foods should make up 'just over a third' of the food pregnant women eat. Examples of such foods are provided, which include potatoes, bread, rice, pasta, and cereals. There is no doubt that African women are familiar with these kinds of food. However, the types of starchy food more commonly and frequently eaten in African households are different from these (for example, fufu, garri, plantains, yams,

cassava and cocoyams). With no guidance on the food groups that these food items belong to, their nutritional content, or benefits/harms in pregnancy, pregnant women may not be able to identify whether or how much of these are appropriate for them. Hence, current guides on nutrition in pregnancy may not be all-inclusive or well-suited to the needs of African migrant women who predominantly consume African food.

10.3. THEORETICAL AND PRACTICAL IMPLICATIONS OF THIS THESIS

This thesis has several applications relating to intervention strategies aimed at preventing and tackling obesity in HICs.

As described in chapters 7 and 8, I situated my findings on women's weight perceptions within the context of two theories that have been used to explain health behaviours. I used the HBM to analyse perceptions of threat; that is, African migrant women's subjective perception of their (and their children's) risk of becoming overweight or obese. Threat perceptions – whether accurate or not – are important predictors of health behaviours (609). The HBM predicts that individuals who perceive that they are susceptible to a particular health problem are more likely to engage in behaviours to reduce their risk of developing the health problem (609). Meanwhile, those with a low perceived susceptibility (like the women in my study) are more likely to deny or under-estimate their risks, and would consequently be unlikely to engage in preventive behaviours. This means African migrant women may be unlikely to show interest or see the need for obesity prevention messages or interventions, especially as they see obesity to be a problem of the West.

I also used the TPB to derive specific findings relating to women's intentions (e.g. intentions to eat healthy or lose weight). The TPB theorises that behavioural intentions and subsequent behaviours can be influenced by subjective norms, which are a person's beliefs about whether people of importance to them think they should engage in certain behaviours (608). I described in chapter 8 how many African women's behaviours and beliefs are influenced by

various people in society, especially their mothers, grandmothers and men – for example, being told what a healthy woman should look like, being advised to eat for two during pregnancy and being cautioned to restrain from PA during pregnancy in order not to hurt the baby. Respect for certain groups of people in society (e.g. for parents, husbands and the elderly) is ingrained in the African culture, and the authority of these people is often unquestioned [754, 755]. Hence, if these significant people in society emphasize that women or children should behave or look a certain way, most women will normally work towards abiding with these guides. So, in as much as people's intentions influence their behaviours, cultural beliefs and expectations also play an important role. I also described some pregnancy taboos in Chapter 8 which are common among African women. This is a clear example of how women are driven by their cultural values to abide to traditions which may restrict their intakes of required nutrients during pregnancy. Factors like these could also influence women to disregard health-related advice from HCPs, as we saw in Chapters 8 and 9.

10.3.1. Tackling obesity using a life-course approach

Several government and international health bodies recommend taking a life-course approach to tackling the obesity epidemic (746, 762). A life course approach provides a holistic view of people's health and targets their needs at critical periods throughout life. It explores the experiences of an individual or a population, identifying patterns of health and disease, and recognising how both their past and present experiences are shaped by their social, economic and cultural contexts (746, 762). This research explores how the experiences of African migrant women both before and after migration influence their behaviours and weight status. It also identifies the needs of African migrant women relating to weight management both before and during pregnancy, and identifies key areas where they may need specific guidance or support. These findings will inform interventions aiming to support women to have healthy weights both before and during pregnancy. The findings are also useful for studies aiming to promote optimal child health – for children to get the best possible start in life, mothers need to be healthy both before and during pregnancy (150).

10.3.2. Nutrition and weight management support in pregnancy

The National Institute for Health Research (NIHR) identified in a report on health before, during and after pregnancy (65), a need for studies focusing on nutrition pertinent to specific ethnic populations, in order to support healthy eating and nutrition education in these groups. This thesis addresses African migrant women's dietary and PA behaviours and outlines how cultural factors influence these. The NIHR report also states that studies addressing cultural barriers with regard to healthy eating and lifestyle (e.g. Chapter 8 of this thesis) are more likely to make a difference to the obesity prevalence in different ethnic groups.

A National Institute for Health and Care Excellence (NICE) (163) guideline highlights the need to support women in achieving and maintaining a healthy weight both before and during pregnancy. The guidelines state that effective weight management programmes should identify and address barriers to change, and address reasons why some individuals might find it difficult to manage their weights. Chapters 6 and 8 address barriers and facilitators to healthy weight management both before and during pregnancy in African migrant women, and contributes relevant information that can be useful for designing appropriate weight interventions for them.

NICE guidelines also recommend that it is important to dispel any pregnancy-related myths, such as, what and how much to eat during pregnancy. In addition to the commonly known myths among pregnant women such as eating for two and avoiding PA due to the belief that it may hurt the unborn child, this research revealed some other myths commonly held by African migrant women. Some of these include cultural beliefs around food aversions in pregnancy, the idea that weight gain in pregnancy is 'uncontrollable' and the belief that babies lose weight as they grow. These findings provide relevant information for health professionals to take into consideration when providing pregnancy advice to these women.

10.3.3. Obesity prevention interventions

Over the years, the UK government has set recommended guidelines and a series of action plans to encourage people to eat healthier and be more physically active. Examples of these include the 5-a-day campaign which aims to increase the consumption of fruit and vegetables, the food in schools policy (763) which aims to improve food quality in schools, salt reduction programmes developed by the Food Standards Agency (764) and Public Health England (765), the Health Weight, Healthy Lives initiative which aims to promote healthier food choices and the incorporation of PA into daily lives (766), and various NICE guidelines on how to prevent excessive weight gain and encourage healthy dietary and PA behaviours (767). However, while ethnic differences in overweight and obesity have been recognised, the various government strategies do not make any distinctions by ethnic group. It is important to recognise that socio-cultural constructs of body weight and approaches towards health vary with different cultures, as seen in chapters 8 and 9 of this thesis. Hence, behaviour change interventions in one population may not be appropriate or effective for another.

There have been several public health campaigns in the UK and other HICs aimed at promoting greater recognition of childhood overweight and obesity amongst parents. One such example is the school-based National Child Measurement Programme where students are weighed and objective BMI information is sent to their parents (768, 769). Meanwhile, there is evidence showing that accurate parental recognition of child overweight and obesity is neither associated with better weight management nor with the implementation of preventative measures (593, 770-772). So, again, understanding the cultural dynamics of a population and the factors that drive behaviour change is important for addressing the obesity epidemic.

NICE guidelines on behaviour change (773) highlight the need to recognise how women's social contexts and relationships may affect their behaviours. Findings from this research showed that being around other African migrants had both positive and negative influences

on women's behaviours. Positive factors included women being encouraged or enabled to maintain their traditional dietary practices, and pregnant women feeling more supported with their pregnancy needs; while negative factors included Africans promoting the idea that women need to be big and curvy, that healthy children should be chubby, that pregnant women need to eat for two and that PA during pregnancy can harm the unborn baby. Meanwhile, being around non-migrants encouraged the adoption of non-African dietary patterns, but also, the idea of wanting to be fit. These findings highlight some important considerations relating to migrant interactions in host countries, how they may influence their weight-related behaviours and whether they may present opportunities for supporting weight management especially in pregnancy. This information would be relevant for designing behaviour change interventions to promote healthy weight gain in African migrant women. For example, it would help to identify who these women are more likely to listen to or learn from, and what aspects of their social lives can influence these changes.

10.3.4. Contributing towards the 2030 Sustainable Development Agenda

A final contribution that this research makes is towards the 2030 Sustainable Development Goals (SDGs) agenda, which recognises the contribution of migration to sustainable development, and aims to provide an opportunity to better serve vulnerable groups (774). Migration is a cross-cutting issue which is relevant to all SDGs, and the agenda calls for data disaggregation by migrant status, in order to gain a better understanding of the different dimensions of migrants' living conditions and health (774-776).

In 2017, the International Organization for Migration (IOM) and the World Health Organization (WHO) hosted a global consultation on migration and health with international researchers and policy makers, where they highlighted an urgent need for research on international migration and health, to support efforts to achieve the SDGs, which aim to 'leave no one behind' (777). From a public health perspective, improving the health of migrants is an important investment with potential benefits for both migrant and native populations (778).

Addressing the determinants of migrants' health and related inequalities will enable them attain their development potential, contribute to sustainable development and also reduce health costs associated with migration both in their countries of origin and destination.

10.4. STRENGTHS AND LIMITATIONS

A major strength of this research lies in its methodological approach, which used both quantitative and qualitative methods. Using a mixed methods approach enabled me to obtain rich and in-depth information specific to my target population, thereby strengthening the understanding of key issues relating to my research aims. The second strength involves the rigorous approach followed during my systematic reviews, consisting of extensive searches performed on multiple databases, the involvement of an experienced information scientist and the duplication of all screening, data extraction and quality assessments to minimise human error. The PRISMA and MOOSE checklists guided the review process from study selection to synthesis, and the study protocol was registered on PROSPERO for transparency.

There are some limitations that might influence the interpretation of results from this thesis, especially relating to the systematic review findings in Chapters 5 and 6. There were high levels of heterogeneity across studies in the systematic reviews in Chapter 5, especially on maternal weight outcomes, and these were not always explained by potential confounders tested for. However, not all potential confounding factors could be explored due to lack of data. Some of the included studies were also not originally designed to assess prevalence of overweight and obesity, which may have subjected them to methodological limitations in the context of the research questions being explored. However, quality assessments found no studies of poor quality.

Many studies were excluded from the reviews in both Chapters 5 and 6 because they either

provided data on both African migrant women and men with no separate analyses for women; or included 'Black' women but did not specify their countries of origin; or grouped heterogeneous migrant populations together (e.g. women and children from the Middle East and North Africa, or from Africa and the Caribbean). As described in section 10.2.1., combining heterogeneous migrant populations may not be reflective of actual weight outcomes in the migrant populations, and may also conceal important risks pertinent to specific population sub-groups. The inclusion of mainly cross-sectional quantitative studies in the reviews also reflects the types of studies available. Studies predominantly included women from North African countries, with fewer women from SSA; and there may be different determining factors across African countries which could not be explored in this thesis.

The qualitative part of this thesis also has some limitations. First, as is usually the case with qualitative studies, the interviews were reliant on participants' ability to recall and honestly recount details about their lives, circumstances and behaviors. Secondly, some important data may have been lost when defining themes to focus on issues that were discussed more frequently. Lastly, all participants were living in England, so their views may not be representative of African migrant women living in the other UK nations. Despite these limitations, this thesis provides useful insights on African migrant women's perceptions of overweight and obesity.

10.5. CONCLUSIONS AND RECOMMENDATIONS

This thesis makes the following original contributions to knowledge:

It is already known that Black women and children in HICs face a disproportionately higher risk of overweight and obesity compared to women and children from other ethnic groups. However, my findings make a significant contribution to the literature, as published data do not differentiate between the weight status of migrant and non-migrant African women and their children. As detailed in Chapter 4, migration plays an important role on the disease susceptibility and health outcomes of migrants, so it is important to consider migrant status when exploring health risks among populations in HICs. This thesis identifies African migrant

women of child-bearing age (both pregnant and non-pregnant) living in HICs and their children as being at high risk of overweight and obesity, thereby providing evidence of a need to address risk factors associated with these risks. Existing studies on overweight and obesity in Black women and children also do not explore regional differences in their weight status, or obesity risks. This thesis has shown that region of origin significantly influenced African migrant women's and children's risks of overweight and obesity, with women and children from North Africa being at higher risk.

This thesis further highlights pre- and post-migration influences on African migrant women's weight related behaviours, and outlines how factors like culture, societal norms and social interactions both in their countries of origin and in HICs influence their weight preferences and their weight management behaviours both before and during pregnancy. Targeting women from SSA in the qualitative phase of this thesis also fills a gap in the existing literature, since existing studies predominantly include women from North Africa.

10.5.1. Recommendations for future research policy and practice

My first recommendation from this thesis is for studies to recognise and stratify data by important variables within migrant groups, such as country of origin, duration of residence in HICs, age at migration and sex. As stated previously, several studies could also not be included in this thesis due to data not being provided separately for African migrant men and women. The absence of this data hinders the understanding and appropriate evaluation of women's needs in and after the migration process. Given the implications of overweight and obesity for women and their children, there is a need to collect and document data related to their experiences from a life course perspective, ideally from the time they arrive at HICs. This will help in understanding the dynamics and realities of women migrating and its implications on their weights and weight-related behaviours. Several data gaps were also identified relating to sociodemographic influences on the weight status of African migrant women and children, weight-related behaviours of pregnant African migrant women, and sociodemographic determinants of African migrant women's behaviours. Further research would be a good

opportunity to explore these gaps and their associations with the risks of overweight and obesity in African migrant women and children. Addressing these knowledge gaps can also help prevent further increases in obesity among these migrant populations, and contribute towards narrowing the inequality gaps in health outcomes in HICs.

Secondly, this thesis has shown both positive and negative influences of migration on women's weight perceptions and behaviours. It is worth looking into how pre- and post-migration influences may contribute towards migrant women's multicultural identities in HICs, and how they can be supported; especially in the areas of weight management. It is also unclear from this thesis whether African migrant women living in HICs are meeting recommendations on PA. Further studies would be useful in determining trends in post-migration PA among these women, especially during pregnancy.

A policy recommendation for HIC governments is to finance the collection of more data on ethnic inequalities in overweight and obesity. Effective health policy and health promotion are costly, but greater gains will be obtained if more is known about the mechanisms behind ethnic differences in obesity. As the African migrant population and other ethnic minorities in HICs grow, it is increasingly important that ethnic health inequalities be understood. Obesity is an important factor associated with many health outcomes, also with serious implications on quality of life; so addressing ethnic inequalities in obesity is fundamental for improving the health of populations in the UK and other HICs.

My recommendation for practice relates to the provision of health care services for African migrant women, especially support with nutrition and weight management in pregnancy. First, it is important for health providers not to make any assumptions, for example assuming that everyone understands the healthcare system. As I reported in Chapter 8, the healthcare system in the UK is different from what the women had experienced in their countries of origin, and such differences can influence their perceptions of what they need, their healthcare seeking behaviours and their use of these services. It is also important to acknowledge how cultural factors can influence their

behaviours (e.g. diet and PA) and weight status, and engage in conversations with them about these, to enable them to express their unique challenges. There is a common stereotype – both in the general society and also in the medical field – that Black women are strong and can handle anything (782, 783). In other words, Black women are required to respond to difficult situations by portraying strength and concealing distress (783). While typically intended as a compliment, such stereotypes may prevent women from expressing their areas of weakness. In my interviews, I found evidence of vulnerability especially when women talked about challenges with making healthy food choices during pregnancy. These women can be better supported by appreciating their unique challenges, listening to their concerns and providing individualised support.

In addition to health providers who were cited as playing an important role in providing guidance on diet and PA in pregnancy, husbands and female relatives were shown to play a major role on women's food and weight-related beliefs, as well as in providing social support. These findings suggest that forming collaborations between health providers and relatives of pregnant African migrant women may be helpful towards supporting healthy pregnancies and facilitating the provision of social support for pregnant women. Further research with relatives involved in caring for pregnant women could also help identify ways to support them throughout their pregnancy. Other strategies that have been identified as relevant for preventing overweight and obesity in African migrants include using relatives as agents of behaviour change, encouraging the retention of healthy traditional food practices, and working with them to identify ways in which their traditional foods can be modified to make them healthier [1, 2].

Lastly, there may be a need to evaluate the cultural appropriateness of the BMI as a measure of obesity across different populations, as its use may be further widening the inequality gaps in weight status between different population groups in HICs. For example, a US study (779) showed that White women with obese BMIs had high risks of type 2 diabetes, high blood pressure and high cholesterol, whereas Black women with the same weight status were

considered medically healthy. The authors attributed the weight gap between Black and White women to how body fat is distributed in their bodies. Another study (780) showed that at the same BMI and waist measurements, Black people had less body fat than White people. The researchers theorised based on these findings that Black people may have higher muscle mass than White people. Different BMI thresholds have been developed for some populations (e.g. Asians), due to them having different body fat distributions and health risk profiles than White populations (140, 141). These findings suggest that it may be necessary to review the suitability of current BMI thresholds for various populations.

APPENDICES

Appendix A: Medline search strategy

1. africa*.mp. [mp = title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
2. exp Africa/
3. African Continental Ancestry Group/
4. (foreign born adj6 black*).mp.
5. ethnic minorit*.mp.
6. 1 or 2 or 3 or 4 or 5
7. “Emigrants and Immigrants”/
8. migrant*.mp.
9. immigrant*.mp.
10. emigrant*.mp.
11. 7 or 8 or 9 or 10
12. exp Women/
13. Mothers/
14. exp Child/
15. infant/ or infant, newborn/
16. (baby or babies).mp. [mp = title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
17. toddler*.mp.
18. offspring.mp.
19. young child*.mp.
20. kindergarten.mp.
21. preschool*.mp.
22. pre-school*.mp.
23. 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
24. exp Obesity/
25. exp Overweight/
26. bodyweight.mp.
27. body weight changes/ or weight gain/
28. maternal obesity.mp.
29. obes*.mp.
30. adiposity.mp.
31. body fat*.mp.
32. fat mass.mp.
33. exp Body Composition/
34. body mass index/ or body size/
35. weight.mp.
36. (obes* adj6 pregnan*).mp.
37. (weight adj6 pregnan*).mp.
38. (bmi adj6 pregnan*).mp.
39. (obes* adj6 prepregnan*).mp.
40. (obes* adj6 pre-pregnan*).mp.
41. (weight adj6 prepregnan*).mp.
42. (weight adj6 pre-pregnan*).mp.
43. (bmi adj6 prepregnan*).mp.
44. (bmi adj6 pre-pregnan*).mp.
45. Eating or diet or food or intake
46. Exercise or activity or PA
47. Pediatric Obesity/
48. Fetal Macrosomia/
49. large for gestational age.mp.
50. weight for height.mp.
51. infant nutrition.mp.

52. (child* adj2 nutrition).mp.
53. infant feeding.mp.
54. (child* adj2 feeding).mp.
55. exp Breast Feeding/
56. complimentary feeding.mp.
57. exclusive breastfeeding.mp.
58. 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57
59. Knowledge or beliefs or perceptions
60. Behaviour* or behavior* or attitude* or habit*
61. Determinant* or factor* or influence*
62. 59 or 60 or 61
63. 6 and 11 and 23 and 56 and 62

Appendix A: Data extraction forms

Reviewer Details			
Name of Reviewer			
Date of Review			
Study citation			
Study context			
Research aim / question(s)			
Study location (country)			
Study setting			
Study duration (including start and end dates if provided)			
Ethical Approval	Yes	No	Not reported
Conflict(s) of interest	Yes	No	Not reported
Methods			
Study type			
Sampling approach and justification			
Inclusion criteria			
Exclusion criteria			
Sample size			
Data collection			
Data collection methods (e.g. survey, interview)			
Data source (e.g study name or data set used)			
Study population	Women☐	Children☐	Both☐
	For studies on women: Pregnant women☐	Non-pregnant women☐	
Baseline characteristics			
Are baseline Characteristics reported?	☐ Yes ☐ No (if no do not complete, if yes populate table below with the data)		
Ascertainment of maternal BMI	☐ Measured ☐ Medical records ☐ Self-reported		
	Other (please specify) ……..		
Ascertainment of child BMI	☐ Measured ☐ Medical records ☐ Reported by mother		
	Other (please specify) ……..		

Outcomes and characteristics									
Maternal outcomes and characteristics (include unit of measurement e.g. Mean and SD or n (%)									
	Definition (Categories)	**Total cohort**	**Total African group**	**Where more than one African group is reported**				**Comparison group (non-African from host country)**	**P- value**
				African group 1	**African group 2**	**African group 3**	**African group 4**		
Age									
Country of origin									
BMI									
Overweight									
Obesity									
Overweight/obesity									
Parity									
Income									
Length of residence in HIC									
Level of education									
Occupation									
Smoking status									
Marital status									

Other..									
Child outcomes and characteristics (include unit of measurement e.g Mean ± SD or n (%)									
BMI									
Overweight									
Obesity									
Overweight/obesity									
Birthweight									
Child age									
Child sex									
Other									

Data Analysis Methods:	
Factors Adjusted for in Analysis:	

Eligible outcomes: Please refer to these outcomes to fill in the data in tables 1 and 2 below (including any relevant figures)	
Maternal outcomes	**Child outcomes**
a) Maternal weight or BMI b) Maternal overweight or obesity c) Maternal dietary behaviours d) Maternal physical activity e) Effects of dietary behaviours on maternal weight status f) Effects of physical activity on maternal weight status g) Maternal underestimation of own or child's weight h) Ethnic differences in above outcomes i) Effects of migration, acculturation or length of residence on any of the above outcomes j) Effects of maternal weight status or BMI on infant feeding	a) Child weight or BMI b) Child overweight or obesity c) Birthweight (high birthweight, macrosomia or low birthweight) d) Effect of mother's weight/BMI on child weight/BMI e) Ethnic differences in above outcomes f) Effects of maternal characteristics on any of the above outcomes

Table 1: Maternal Outcomes - Please copy findings on any of the eligible maternal outcomes reported on African-born migrant women into the table

Table 2: Child Outcomes - Please copy findings on any of the eligible child outcomes on African children into the table

Appendix B: Quality assessment of systematic review studies

C1: Quality assessment criteria for quantitative studies

Q1. Was the research question or objective in this paper clearly stated?
Q2. Was the study population clearly specified and defined?
Q3. Was the participation rate of eligible persons at least 50%?
Q4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?
Q5. Was a sample size justification, power description, or variance and effect estimates provided?
Q6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?
Q7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?
Q8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?
Q9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
Q10. Was the exposure(s) assessed more than once over time?
Q11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
Q12. Were the outcome assessors blinded to the exposure status of participants?
Q13. Was loss to follow-up after baseline 20% or less?
Q14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?

2: Quality assessment results for qualitative studies

Author, year & reference number	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Total score	Quality rating
Agyemang et al. 2009 (488)	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Ahmed et al. 2018 (476)	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Aronsen et al. 2015 (480)	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Bahadoer et al. 2015 (482)	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Bakken et al. 2015 (515)	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Belihu et al. 2016 (527)	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Bjermo et al. 2015 (481)	Y	N	N	Y	Y	Y	N	Y	Y	N	Y	N	Y	N	8	Good
Buekens et al, 1998 (507)	Y	Y	N	N	N	Y	Y	Y	Y	N	N	N	Y	N	7	Fair
Calderon-Margalit et al. 2015 (522)	Y	Y	N	Y	N	N	N	Y	Y	N	N	N	Y	N	6	Fair
Casali et al. 2015 (475)	Y	Y	N	Y	N	N	Y	Y	Y	N	N	N	Y	N	7	Fair
Cohen et al. 2017 (469)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Dassanayake et al. 2011 (407)	Y	Y	N	Y	N	Y	N	Y	Y	N	N	N	Y	N	7	Fair
David et al. 1997 (523)	Y	Y	N	Y	N	N	N	Y	Y	N	N	N	Y	N	6	Fair
De Hoog et al. 2011 (509)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
De Hoog et al. 2012 (483)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Delisle et al. 2009 (540)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
De Wilde et al. 2009 (508)	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y	N	Y	Y	10	Good
Dijkshoorn et al. 2011 (485)	Y	Y	N	Y	N	N	N	Y	Y	N	N	N	Y	N	6	Fair
Dijkshoorn et al. 2014 (498)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Djelantik et al. 2011 (484)	Y	N	N	Y	N	Y	N	Y	Y	N	Y	N	Y	N	7	Fair
Dominguez et al., 2008 (474)	Y	Y	N	Y	N	Y	N	Y	Y	N	Y	N	Y	N	7	Fair
Elo et al. 2010 (495)	Y	N	N	Y	N	Y	N	Y	Y	N	N	N	Y	N	6	Fair
Fang et al. 1999 (524)	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	10	Good

Author, year & reference number	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Total score	Quality rating
Gele et al. 2013 (477)	Y	Y	N	Y	N	N	N	Y	Y	N	Y	N	Y	N	7	Fair
Gil et al. 2005 (478)	Y	Y	N	Y	N	Y	N	Y	Y	N	Y	N	Y	N	8	Fair
Gualdi-Russo et al. 2009 (472)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Gualdi-Russo et al. 2016 (471)	Y	Y	N	Y	N	N	Y	Y	Y	N	N	N	Y	N	7	Fair
Guendelman et al. 1999 (505)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Harding et al. 2006 (520)	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	10	Good
Jeannot et al. 2015 (519)	Y	N	N	Y	N	N	N	Y	Y	N	Y	N	Y	N	6	Fair
Johnson et al. 2004 (526)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Juarez et al. 2014 (516)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Kelly et al. 2009 (490)	Y	N	N	Y	N	N	N	Y	Y	N	Y	N	Y	Y	7	Fair
Khanolkar et al. 2015 (518)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Labree et al. 2015 (511)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Lindsay et al. 2014 (470)	Y	Y	Y	Y	N	N	N	Y	Y	N	Y	N	Y	Y	8	Good
Mehta et al. 2015 (499)	Y	N	N	Y	N	Y	N	Y	Y	N	Y	N	Y	N	7	Fair
Menigoz et al. 2009 (491)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Nicolaou et al. 2008 (419)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Oza-Frank et al. 2009 (781)	Y	Y	N	Y	N	N	Y	Y	Y	N	N	N	Y	N	7	Fair
Prado et al. 2004 (506)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Regev et al. 2012 (493)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Renzaho 2006 (543)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Restrepo-Mesa et al. 2015 (517)	Y	Y	N	Y	N	N	N	Y	Y	N	N	N	Y	N	6	Fair
Roshania et al. 2008 (415)	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	11	Good
Rovillé-Sausse et al. 1998 (468)	Y	Y	N	Y	N	N	Y	Y	Y	N	N	N	Y	N	7	Fair
Saleh et al. 2002 (492)	Y	Y	N	Y	N	N	N	Y	Y	N	Y	N	Y	N	7	Fair

Author, year & reference number	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Total score	Quality rating
Smith et al . 2011 (537)	Y	N	N	Y	N	Y	N	Y	Y	N	Y	N	Y	N	7	Fair
Snoek at al. 2007 (512)	Y	Y	N	Y	N	N	N	Y	Y	N	N	N	Y	N	6	Fair
Somaraki et al. 2018 (500)	Y	Y	N	Y	N	N	N	Y	Y	N	N	N	Y	N	6	Fair
Toselli et al. 2014 (244)	Y	N	N	Y	N	Y	N	Y	Y	N	N	N	Y	N	7	Fair
Toselli et al. 2015 (473)	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	10	Good
Troe et al. 2007 (513)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Ujcic-Voortman et al. 2011 (489)	Y	Y	N	Y	N	N	N	Y	Y	N	Y	N	Y	N	7	Fair
Vahratian et al. 2004 (467)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Van Poppel et al. 2012 (487)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good
Vang et al. 2013 (525)	Y	N	Y	N	Y	Y	N	Y	Y	N	Y	N	Y	Y	9	Good
Vangen et al. 2002 (514)	Y	Y	N	Y	N	N	N	Y	Y	N	N	N	Y	N	6	Fair
Veldhuis et al. 2013 (510)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	11	Good

Y – Yes: Criterion satisfied; N – No: Criterion not satisfied or not reported

C3: CASP criteria for qualitative studies

	Study	Garnweidner et al., 2012 (426)	Nicolaou et al. 2012 (418)	Persson et al. 2014 (541)	Quintanilha et al. 2016 (542)
1	Was there a clear statement of the aims of the research?	Y	Y	Y	Y
2	Is a qualitative methodology appropriate?	Y	Y	Y	Y
3	Was the research design appropriate to address the aims of the research?	Y	Y	Y	Y
4	Was the recruitment strategy appropriate to the aims of the research?	Y	Y	Y	Y
5	Was the data collected in a way that addressed the research issue?	Y	Y	Y	Y
6	Has the relationship between researcher and participants been adequately considered?	Y	N	Y	N
7	Have ethical issues been taken into consideration?	Y	Y	Y	Y
8	Was the data analysis sufficiently rigorous?	Y	N	Y	N
9	Is there a clear statement of findings?	Y	Y	Y	Y
10	How valuable is the research?	Y	Y	Y	Y
	Quality assessment result	Good	Good	Good	Good

Appendix C: Meta-analyses of mean BMI in women – Meta-regression, sensitivity analysis and forest plot results

D1: Meta regression analysis results for mean BMI meta-analysis

Variable	Meta regression residual I^2, (%)	P-value
All studies	**95.4**	
Sample size	91.03	0.01*
Study design	93.53	0.62
Study quality	94.28	0.29
Host country	94.27	0.67

Footnote: *Factor was significantly contributing to heterogeneity

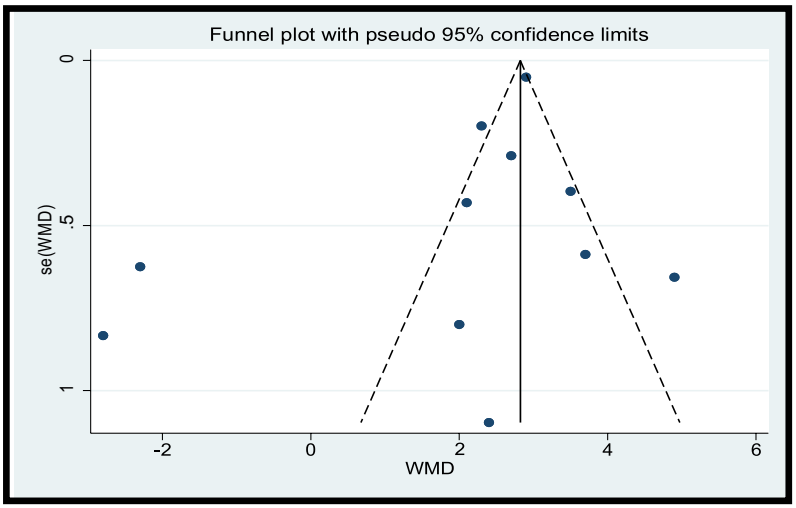
D2: Sensitivity analysis results for mean BMI meta-analysis

Excluded study	WMD (95% CI)	Interpretation
Vahratian et al. 2004 (467)	2.45 (2.07 to 2.82)	Overall result: Mean BMI for African migrant women was significantly higher than that for non-African women
Van Poppel et al. 2012 (487)	2.28 (1.91 to 2.66)**	
Bahadoer et al. 2015 (482)	2.61 (2.09 to 3.15)*	
Toselli et al. 2015 (473)	1.82 (0.28 to 3.45)	
Menigoz et al. 2016 (491)	2.52 (1.49 to 3.54)*	
Mehta et al. 2015 (499)	2.48 (1.34 to 3.62)	
Dijkshoorn et al. 2011 (485)	1.59 (0.15 to 3.04)**	
Gualdi-Russo et al. 2009 (472)	1.80 (0.44 to 3.17)	
Gualdi-Russo et al. 2016 (471)	1.44 (0.56 to 2.82)	
Ujcic-Voortman et al. 2011 (489)	1.67 (0.30 to 3.64)	
De Hoog *et al*. 2012 (483)	1.37 (0.45 to 3.22)	

Footnote: sensitivity analyses were performed by excluding one study at a time. *Study had the strongest association on the overall effect

**Study had the weakest association on the overall effect

D3: Funnel plot for mean BMI meta-analysis



Appendix D: Meta-analyses of overweight and obesity in women – Meta-regression, sensitivity analysis and forest plot results

E1. Meta-regression analysis results for overweight and obesity meta-analyses

Variable	Meta regression residual I^2, (%)	P-value
Results for obesity		
All studies	**98.5%**	
Sample size	90.5	0.32
Study design	94.75	0.67
Study quality	86.7	0.45
Host country	90.9	0.51
Results for overweight		
All studies	**98.0**	
Sample size	79.9	0.71
Study design	86.6	0.28
Study quality	83.4	0.16
Host country	88.6	0.94
Results for combined overweight/obesity		
All studies	**98.3**	
Sample size	97.9	0.32
Study design	96.9	0.28
Study quality	90.3	0.17
Host country	89.5	0.11

E2: Sensitivity analysis results for overweight, obesity and combined overweight/obesity in African migrant women compared to non-African women

(i) Sensitivity analysis results for obesity meta-analysis

Excluded study	OR (95% CI)	Result	Interpretation
Pregnant women			
Van Poppel et al. 2012 (487)	2.40 (1.38 – 4.20)	Significant	ORs for OB were significantly higher for both pregnant and non-pregnant African migrant women compared to non-African women. Results remained significant when any of the studies were excluded from the meta-analysis.
Djelantik at al. 2015 (484)	2.34 (1.40-3.91)	Significant	
Bjermo et al. 2015 (481)	2.28 (1.16-6.87)	Significant	
Elo et al. 2010 (495)	3.04 (1.73-5.35)	Significant	
Non-pregnant women			
Toselli et al. 2015 (473)	2.49 (1.42 – 4.36)	Significant	
Dijkshoorn et al. 2011 (485)	2.44 (1.39-4.27)	Significant	
Gualdi-Russo et al. 2016 (471)	2.41 (1.38-4.21)	Significant	
Ujcic-Voortman et al. 2012 (489)	2.48 (1.41-4.35)	Significant	
Mehta et al. 2015 (499)	3.12 (1.72-5.65)*	Significant	
Dijkshoorn et al. 2014 (498)	2.25 (1.30-3.89)**	Significant	

Footnote: sensitivity analyses were performed by excluding one study at a time. OR – odds ratio; CI – confidence interval; OB – obesity; *Study had the strongest association on the overall effect; **Study had the weakest association on the overall effect

(ii) Sensitivity analysis results for overweight meta-analysis

Study excluded	OR (95% CI)	Result	Interpretation
Pregnant women			
Van Poppel et al. 2012 (487)	2.31 (1.5–3.46)	Significant	ORs for OW were significantly higher for both pregnant and non-pregnant African migrant women compared to non-African women. Results remained significant when any of the studies were excluded from the meta-analysis.
Djelantik at al. 2015 (484)	2.29 (1.61–3.26)	Significant	
Bjermo et al. 2015 (481)	2.73 (1.56–4.76)	Significant	
Non-pregnant women			
Toselli et al. 2015 (473)	2.46 (1.62 – 3.73)	Significant	
Gualdi-Russo et al. 2016 (471)	2.26 (1.51–3.39)	Significant	
Ujcic-Voortman et al. 2012 (489)	2.62 (1.72–3.99)	Significant	
Mehta et al. 2015 (499)	2.83 (1.70–4.71)*	Significant	
Dijkshoorn et al. 2014 (498)	2.15 (1.46–3.17)**	Significant	

Footnote: sensitivity analyses were performed by excluding one study at a time. OR – odds ratio; CI – confidence interval; OW – overweight; *Study had the strongest association on the overall effect; **Study had the weakest association on the overall effect

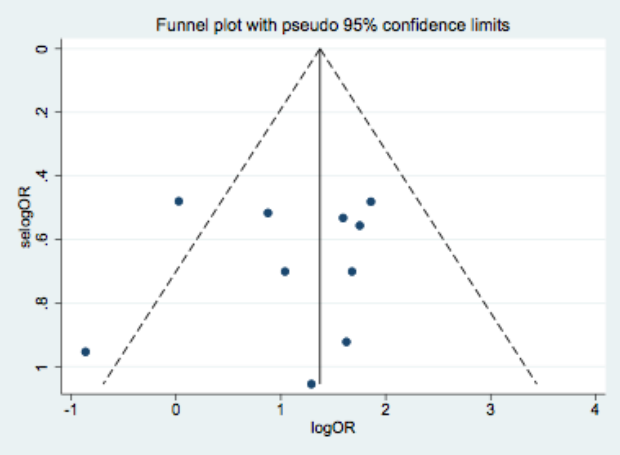
(iii) Sensitivity analysis results for combined overweight/obesity meta-analysis

Study excluded	OR (95% CI)	Result	Interpretation
Pregnant women			
Bahadoer et al. 2015 (482)	4.14 (3.64–4.71)	Significant*	OR for OW/OB was significant for pregnant African migrant women compared to pregnant non-African women. Results remained significant when any of the studies were excluded from the meta-analysis.
Bjermo et al. 2015 (481)	3.34 (2.14–5.22)	Significant	
Djelantik et al. 2015 (484)	2.98 (1.64–5.43)	Significant**	
Van Poppel et al. 2012 (487)	3.04 (1.65–5.61)	Significant	
Elo et al. 2010 (495)	3.34 (2.14–5.22)	Significant	
Non-pregnant women			
Menigoz et al. 2016 (491)	2.59 (1.06–6.35)*	Significant*	OR for OW/OB in non-pregnant African migrant women compared to non-pregnant non-African women was not significant ORs became significantly higher for African women when any of two studies (481, 495) were excluded.
Somaraki et al. 2018 (500)	2.03 (0.86–4.77)	Non-significant	
Dijkshoorn et al. 2014 (498)	1.85 (0.82–4.17)	Non-significant	
Mehta et al. 2015 (499)	2.52 (1.35–4.70)	Significant	
Ujcic-Voortman et al. 2012 (489)	2.07 (0.83–5.14)	Non- significant	
Gualdi-Russo et al. 2016 (471)	1.82 (0.80–4.15)**	Non- significant**	
Dijkshoorn et al. 2011 (485)	1.88 (0.82–4.33)	Non- significant	
Toselli et al. 2015 (473)	2.05 (0.85–4.94)	Non- significant	

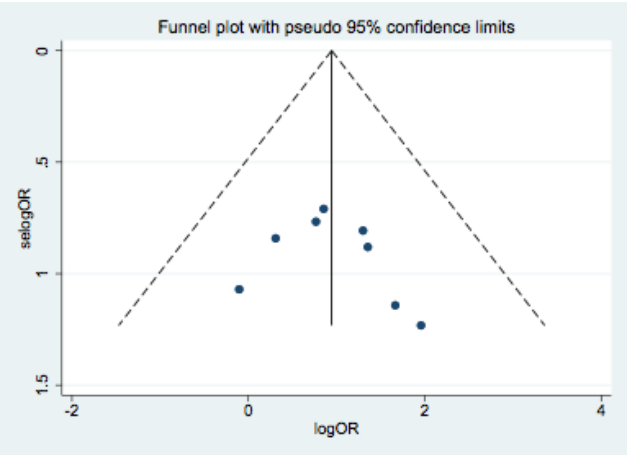
Footnote: sensitivity analyses were performed by excluding one study at a time. OR – odds ratio; CI – confidence interval; OW – combined overweight/obesity; *Study had the strongest association on the overall effect **Study had the weakest association on the overall effect

E3: Funnel plots for overweight, obesity and combined overweight/obesity meta-analyses

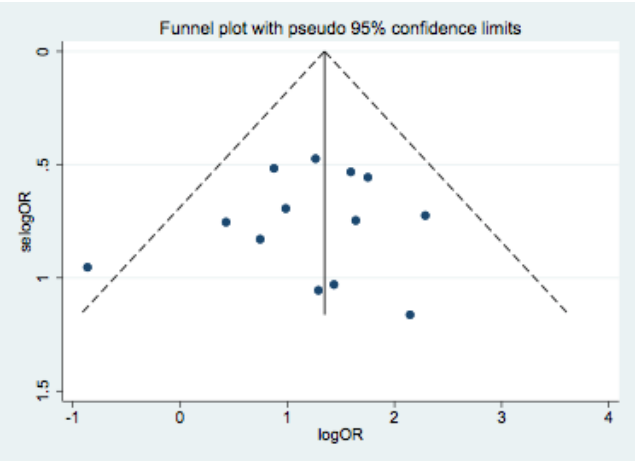
(ii) Obesity



(i) Overweight



(iii) Overweight/obesity



Appendix E: Meta-analyses of overweight and obesity in children – Meta-regression, sensitivity analysis and forest plot results

F1. Meta regression analyses for overweight and obesity meta-analyses

(i) Meta-regression results for child overweight/obesity

Variable	Meta regression residual I^2, (%)
All studies	66
Sample size	69.8, p=0.15
Host country	74.3, p=0.47
Study quality	69.1, p=0.44

(ii) Meta-regression results for child obesity

Variable	Meta regression residual I^2, (%)
All studies	63.8
Sample size	55.3, p=0.75
Host country	64.4, p=0.33
Study quality	62.7, p=0.69

(iii) Meta-regression results for child overweight

Variable	Meta regression residual I^2, (%)
All studies	77.8
Sample size	75.5, p=0.75
Host country	84.6, p=0.33
Study quality	82.7, p=0.69

F2. Sensitivity analyses for child overweight and obesity meta-analyses

(i) Sensitivity analysis results for child overweight/obesity

Study excluded	OR (95% CI)	Result	Interpretation
Veldhius et al. 2013 (510)	2.25 (1.23 – 4.11)	significant	Overall results showed significantly higher OR for child OW/OB in African children compared to non-African children.
De Hoog et al. 2012 (483)	1.92 (1.46 – 2.52)	significant**	
Toselli et al. 2014 (244)	2.71 (1.61 – 4.54)	significant	
Labree et al. 2015 (511)	2.32 (1.31 – 4.15)	significant	
Toselli et al. 2015 (473)	2.39 (1.34 – 4.27)	significant*	
Somaraki et al. 2018 (500)	2.29 (1.30 – 4.03)	significant	
DeWilde et al. 2009 (508)	2.25 (1.15 – 4.39)	significant	
Khanolkar et al. 2013 (518)	2.34 (1.29 – 4.21)	significant	

Study excluded	OR (95% CI)	Result	Interpretation
Jeannot et al. 2015 (519)	2.31 (1.33 – 4.40)	significant	ORs remained significant when any of the studies were excluded from the meta-analysis.
Snoek et al. 2007 (512)	2.17 (1.56 – 3.89)	significant	

Footnote: Sensitivity analysis was done by excluding one study at a time from the meta-analysis, to identify the effect of each individual study. OR–odds ratio; CI–confidence interval; OW/OB–overweight/obesity; *Study had the strongest association on the overall effect ** Study had the weakest association on the overall effect

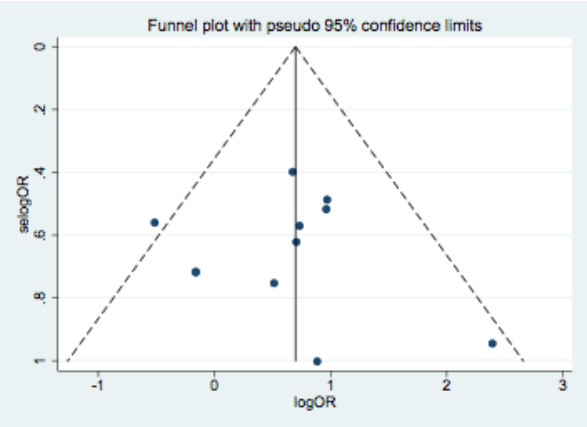
(ii) Sensitivity analysis results for child overweight and obesity

Study excluded	OR (95% CI) and statistical significance				Interpretation
	Overweight		Obesity		
Toselli et al. 2014 (244)	2.24 (1.59 – 3.14)	significant	2.40 (1.35 – 4.26)*	significant	ORs for child OW and OB were significantly higher for African children compared to non-African children. Results were no longer significant when any of two studies (473, 508) were excluded from the analyses
Toselli et al. 2015 (473)	1.23 (0.28 – 5.36)	not significant	1.57 (0.37 – 6.64)	not significant	
DeWilde et al. 2009 (508)	1.00 (0.33 – 2.97)	not significant	1.16 (0.50 – 2.66)**	not significant	
Jeannot et al. 2015 (519)	2.43 (1.61 – 3.43)	significant	2.01 (1.16 – 2.27)	significant	
Snoek et al. 2007 (512)	2.02 (1.30 – 2.98)	significant	1.77 (1.35 – 3.21)	significant	

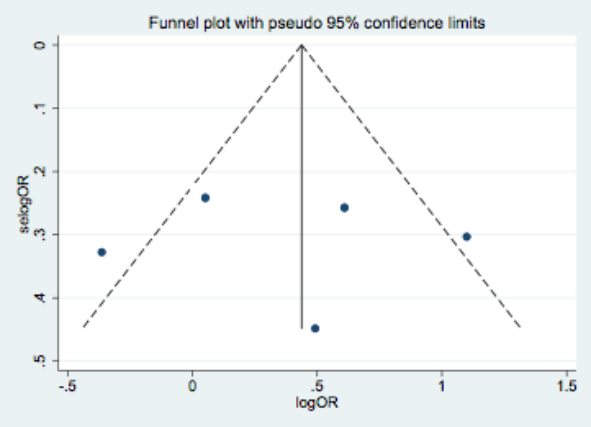
Footnote: Sensitivity analysis was done by excluding one study at a time from the meta-analysis, to identify the effect of each individual study. OR–odds ratio; CI–confidence interval; OW–overweight; OB–obesity; *Study had the strongest association on the overall effect ** Study had the weakest association on the overall effect

F3: Funnel plots for child overweight, child obesity and child overweight/obesity meta-analyses

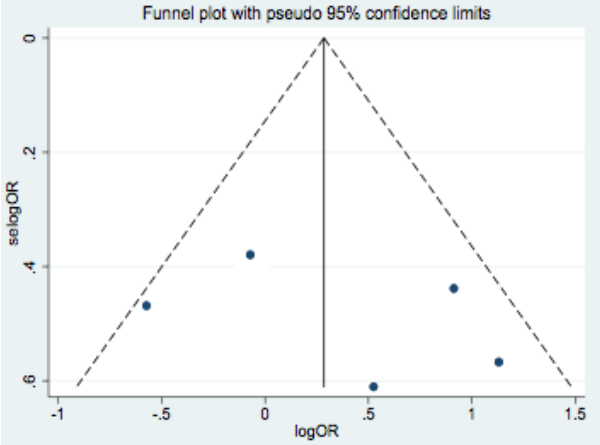
(ii) Child overweight/obesity



(i) Child overweight



(iii) Child obesity



Appendix F: Meta-analyses of birthweight, macrosomia and low birthweight – Meta-regression, sensitivity analysis and forest plot results

G1: Meta-regression results for birthweight meta-analysis

(i) Meta-regression results for mean birthweight

Variable	Meta regression residual I^2, (%)
All studies	97.3
Sample size	89.68, p=0.362
Study quality	89.11, p=0.21
Host country	90.18, p=0.03*
Study year	84.58, p=0.04*

Footnote: *Factor was significantly contributing to heterogeneity

(ii) Meta-regression results for macrosomia

Variable	Meta regression residual I^2, (%)
All studies	97.9
Sample size	84.58, p<0.01 (significant)
Study quality	89.11, p=0.21
Host country	84.58, p=0.32
Study year	88.6, p=0.14

(iii) Meta-regression results for low birthweight

Variable	Meta regression residual I^2, (%)
All studies	99.8
Sample size	98.70, p=0.71
Study quality	89.11, p=0.21
Host country	99.52, p=0.37
Study year	97.6, p=0.31

G2: Sensitivity analysis for birthweight meta-analyses

(i) Sensitivity analysis results for mean birthweight

Study excluded	WMD (95% CI)	Statistical result	Interpretation
Kelly et al. 2008 (490)	57.74 (12.45 – 102.9)	Significant	Overall results showed significantly higher mean BW for African children compared to non-African children.
Vahratian et al. 2004 (467)	39.75 (-7.08 - 86.56)	Not significant	
Buekens et al. 1998 (507)	38.22 (-26.62 - 103.06)	Not significant	
Vang et al. 2013 (525)	36.39 (-18.13 - 90.91)	Not significant**	
Toselli et al. 2015 (473)	48.05 (2.18 - 93.92)	Significant	
De Hoog et al. 2011 (509)	66.77 (24.97 - 108.58)	Significant	
Prado et al. 2004 (506)	49.52 (3.34 - 95.69)	Significant	Results were no longer significant when any of four studies were excluded from the meta-analysis
Prado et al. 2004 (506)	46.65 (1.24 - 92.05)	Significant	
Guendelman et al. 1999 (505)	41.75 (-5.75 - 89.25)	Not significant	
Guendelman et al. 1999 (505)	37.1 (-17.54 - 91.96)	Not significant	
Troe et al. 2007 (513)	50.35 (4.06 - 96.64)	Significant	
Vangen et al. 2002 (514)	50.74 (4.88 - 96.59)	Significant	
Bakken et al. 2015 (515)	72.77 (37.01 - 108.53)	Significant*	

Footnote: Sensitivity analysis was done by excluding one study at a time from the meta-analysis, to identify the effect of each individual study; BW–birthweight; *Strongest association **weakest association

(ii) Sensitivity analysis results for macrosomia

Study excluded	OR (95% CI)	Statistical result
Belihu et al., 2016 (527)	1.86 (1.80 - 1.93)	Significant
Juarez et al. 2014 (516)	1.91 (1.84 - 1.99)	Significant*
Resptrepo-Mesa et al. 2015 (517)	1.47 (1.39 - 1.55)	Significant
Johnson et al. 2004 (526)	1.85 (1.79 - 1.91)	Significant
Bakken et al. 2015 (515)	1.84 (1.78 - 1.89)	Significant**
Calderon-Margalit et al. 2015 (522)	1.87 (1.81 - 1.93)	Significant

Footnote: Sensitivity analysis was done by excluding one study at a time from the meta-analysis, to identify the effect of each individual study; *Strongest association **weakest association

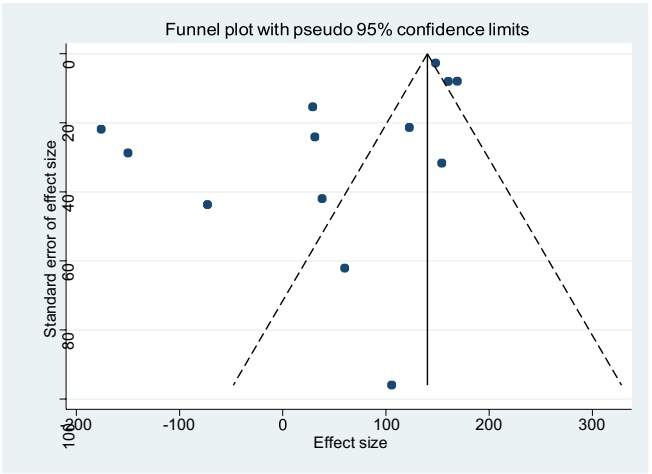
(i) Sensitivity analysis results for low birthweight

Study excluded	OR (95% CI)	Statistical result
Belihu et al., 2016 (527)	1.07 (0.53 - 2.16)	Not significant
Juarez et al. 2014 (516)	0.94 (0.68 - 1.29)	Not significant
Resptrepo-Mesa et al. 2015 (517)	1.13 (0.56 - 2.29)	Not significant
Buekens at al. 1998 (507)	1.16 (0.60 - 2.25)	Not significant*
David et al. 1997 (523)	0.97 (0.49 - 1.94)	Not significant
Fang et al. 1999 (524)	0.99 (0.51 - 1.97)	Not significant
Kelly et al. 2015 (490)	1.03 (0.53 - 2.04)	Not significant
Harding et al. 2004 (520)	1.09 (0.55 - 2.14)	Not significant
Johnson et al. 2004 (526)	1.06 (0.53 - 2.16)	Not significant

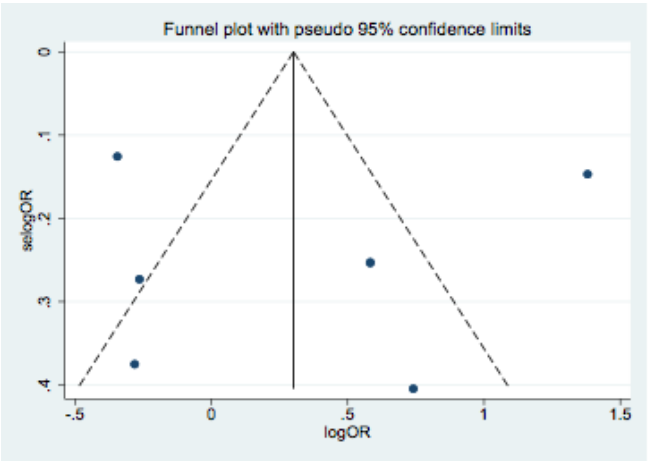
Footnote: Sensitivity analysis was done by excluding one study at a time from the meta-analysis, to identify the effect of each individual study. *Strongest association **weakest association

G3: Funnel plots for birthweight meta-analyses

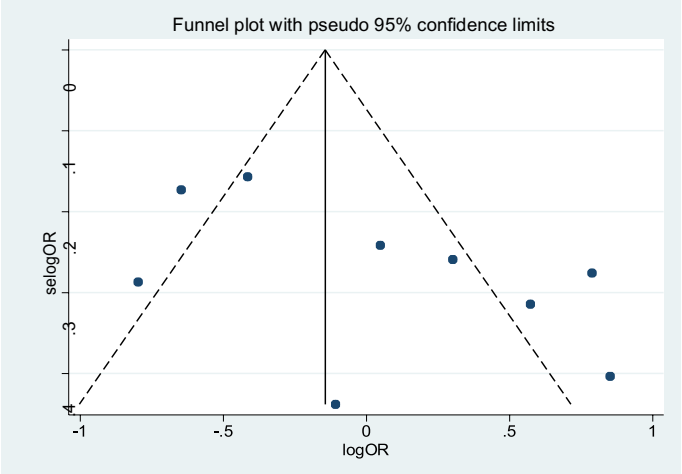
(i) Mean birthweight



(ii) Macrosomia



(iii) Low birthweight



Appendix G: Characteristics of children's mothers and influence on child weight outcomes

H1. Maternal characteristics

Study	Maternal age Mean (SD) or %	Maternal weight status Mean (SD) or %	Maternal education level (%)	Marital status Married or co-habiting (%)	Parity 3 or more children (%) or mean (SD)	Smoking during pregnancy Yes (%)	Alcohol consumption during pregnancy Yes (%)	Socioeconomic status Low (%)
Bakken et al. 2015 (515)	African: 28.8 (6.0) Non-African: 31.8 (4.5)	NR	<12 years African: 69.1 Non-African: 27.9 ≥12 years African: 3.6 Non-African: 72.0	African: 64.7 Non-African: 95.0	African: 74.1 Non-African: 48.1	African: 4.3 Non-African: 13.1	NR	NR
Belihu et al. 2016 (521)	<35 years African: 79.6 Non-African: 76.2 ≥35 years African: 17.1 Non-African: 20.4	NR	NR	African: 77.7 Non-African: 69.9	African: 73.1 Non-African: 57.4	NR	NR	NR
Calderon-Margalit et al. 2015 (522)	<35 years African: 95 Non-African: 98.2 ≥35 years African: 5 Non-African: 1.8	NR	NR	African: 78.3 Non-African: 93.6	African: 63.1 Non-African: 50	NR	NR	African: 51.9 Non-African: 33.9
Buekens et al.1998 (507)	NR	NR	NR	African: 97.7 Non-African: 92.8	NR	NR	NR	NR
David et al. 1997 (523)	<20 years African: 1.5 Non-African: 58.8	NR	<12 years African: 1.5 Non-African: 8.8	NR	African: 31.0 Non-African: 15.0	NR	NR	NR
Fang et al. 1999 (524)	<35 years African: 86.7 Non-African: 86.6	NR	High school or higher: African: 43.9 Non-African: 35.1	African: 60.3 Non-African: 27.4	NR	African: 0.8 Non-Africa: 15.3	African: 0.3 Non-Africa: 3.6	African: 57.2 Non-African: 69.5

Study	Maternal age Mean (SD) or %	Maternal weight status Mean (SD) or %	Maternal education level (%)	Marital status Married or co-habiting (%)	Parity 3 or more children (%) or mean (SD)	Smoking during pregnancy Yes (%)	Alcohol consumption during pregnancy Yes (%)	Socioeconomic status Low (%)
Guendelman et al. 1999 (505)*	Study population in France <35 years African: 75.0 Non-African: 99.5 Study population in Belgium <35 years African: 98.7 Non-African: 99.5	NR	Study in France: >12 years African: 1.5 Non-African: 8.8 Study in Belgium - NR	In France African: 80.6 Non-African: 59.6 In Belgium African: 96.5 Non-African: 85.8	In France African: 73.4 Non-African: 57.1 In Belgium African: 66.3 Non-African: 44.9	In France African: 10.3 Non-African: 26.9 In Belgium - NR	NR	NR
Harding et al. 2006 (520)	African: 30.3 (SD NR) Non-African: 28.0 (SD NR)	NR	NR	NR	NR	NR	NR	NR
Johnson et al. 2004 (526)	<35 years African: 88.6 Non-African: 84.9	ppweight ≥158 lbs African: 27.7 Non-African: 34.6	High school or less: African: 87.9 Non-African: 42.0	African: 77.5 Non-African: 74.9	NR	African: 0.3 Non-African: 15.6	NR	NR
Juarez et al. 2014 (516)	<35 years African: 81.5 Non-African: 68.1	NR	College or higher: African: 5.2 Non-African: 38.0	African: 69.2 Non-African: 65.4	NR	NR	NR	NR
Kelly et al. 2009 (490)	<30 years African: 37.5 Non-African: 42.8 ≥40 years African: 4.6 Non-African: 2.2	African: 25.3 (SD NR) Non-African: 23.7 (SD NR)	A-Levels or higher African: 57.1 Non-African: 61.1	African: 61.3 Non-African: 86.8	African: 32.9 Non-African: 20.1	African: 6.4 Non-African: 22.6	African: 6.9 Non-African: 11.1	African: 37.1 Non-African: 18.4
Prado et al. 2004 (506)*	Study population in France: African: 31.0 (5.4) Non-African: 30.7 (4.7)	In France: African: 24.7 (4.9)	NR	NR	In France: African: 2.5 (1.2) Non-African: 1.8 (1.1)	NR	NR	NR

Study	Maternal age Mean (SD) or %	Maternal weight status Mean (SD) or %	Maternal education level (%)	Marital status Married or co-habiting (%)	Parity 3 or more children (%) or mean (SD)	Smoking during pregnancy Yes (%)	Alcohol consumption during pregnancy Yes (%)	Socioeconomic status Low (%)
	Study population in Italy: African: 29.2 (4.5) Non-African: 27.9 (4.5)	Non-African: 22.1 (3.8) In Italy: African: 25.6 (3.9) Non-African: 22.6 (3.4)			In Italy: African: 2.8 (0.5) Non-African: 1.2 (1.0)			
Restrepo-Mesa et al. 2015 (517)	<30 years African: 55.4 Non-African: 27.5	NR	Secondary school or higher African: 55.4 Non-African: 27.5	African: 88.4 Non-African: 72.0	African: 9.2 Non-African: 1.7	NR	NR	NR
Roville-Sausse, 1998 (468)	African: 27.7 (SD NR) Non-African: 28.5 (SD NR)	NR	NR	NR	African: 47.0 Non-African: 23.0	NR	NR	NR
Troe et al. 2007 (513)	African: 27.9 (5.1) Non-African: 31.2 (4.5)	African: 26.6 (4.8) Non-African: 24.3 (4.2)	Secondary school or higher African: 64.2 Non-African: 93.9	African: 90.4 Non-African: 44.5	African: 58.6 Non-African: 39.4	African: 4.9 Non-African: 17.0	African: 3.1 Non-African: 49.0	NR
Vahratian et al. 2004 (467)	<34 years African: 57.1 Non-African: 60	African: 24.8 (SD NR) Non-African: 22.9 (SD NR)	High school or higher African: 34.6 Non-African: 53.6	African: 92.9 Non-African: 83.3	African: 23.8 Non-African: 9.0	African: 6.8 Non-African: 37.7	NR	NR
Vang et al. 2013 (525)	<30 years African: 38.9 Non-African: 70.8	NR	College or higher African: 58.7 Non-African: 37.8	African: 67.8 Non-African: 25.8	NR	African: 0.5 Non-African: 13.9	African: 0.5 Non-African: 1.9	NR
Vangen et al. 2003 (514)	NR	NR	NR	NR	NR	NR	NR	NR

Study	Maternal age Mean (SD) or %	Maternal weight status Mean (SD) or %	Maternal education level (%)	Marital status Married or co-habiting (%)	Parity 3 or more children (%) or mean (SD)	Smoking during pregnancy Yes (%)	Alcohol consumption during pregnancy Yes (%)	Socioeconomic status Low (%)
De Hoog et al. 2011 (509)	African: 28.3 (5.9) Non-African: 32.4 (4.1)	African: 24.8 (4.8) Non-African: 22.6 (3.3)	>10 years African: 7.3 Non-African: 58.7	NR	African: 25.9 Non-African: 7.5	African: 6.5 Non-African: 9.6	NR	NR
De Hoog et al. 2012 (483)	African: 34.5 (5.6) Non-African: 38.3 (3.8)	African: 26.4 (5.8) Non-African: 23.2 (3.7)	High school or higher African: 52.9 Non-African: 93.7	NR	NR	NR	NR	NR
De Wilde et al. 2009 (508)	NR	NR	NR	NR	NR	NR	NR	NR
Khanolar et al. 2013 (518)	NR	NR	NR	NR	NR	NR	NR	NR
Labree et al. 2015 (511)	NR	African: 25.7 (4.0) Non-African: 24.2 (3.9)	High school or higher African: 65.5 Non-African: 87.6	NR	NR	NR	NR	NR
Somaraki et al. 2018 (479)	African: 33.4 (SD NR) Non-African: 37.1 (SD NR)	%OW/OB African: 50 Non-African: 27.7	>12 years African: 43.8 Non-African: 63.6	NR	NR	NR	NR	NR
Toselli et al. 2014 (530)	NR	NR	NR	NR	NR	NR	NR	NR
Veldhuis et al. 2013 (510)	African: 36.1 (6.9) Non-African: 36.7 (4.4)	%OW/OB African: 48.0	NR	NR	NR	NR	NR	NR

Study	Maternal age Mean (SD) or %	Maternal weight status Mean (SD) or %	Maternal education level (%)	Marital status Married or co-habiting (%)	Parity 3 or more children (%) or mean (SD)	Smoking during pregnancy Yes (%)	Alcohol consumption during pregnancy Yes (%)	Socioeconomic status Low (%)
		Non-African: 29.9						
Toselli et al. 2015 [27]	NR	African: 24.9 (3.6) Non-African: 22.8 (3.6)	High school or higher African: 39.1 Non-African: 66.4	NR	NR	NR	NR	NR
Snoek at al. 2007 (512)	NR	NR	NR	NR	NR	NR	NR	NR
Jeannot et al. 2015 (519)	NR	NR	NR	NR	NR	NR	NR	NR
Summary	African mothers were: younger than non-African mothers in 10/20 studies Older than non-African mothers in 7/20 studies of similar age in 3/20 studies	African mothers had higher mean BMI/ppweight or were more likely to have OW/OB (n=11/11 studies)	African mothers had lower levels of education in=12/16 studies	African mothers more likely to be married (n=10/13 studies)	African mothers had higher parity (n=12/12)	African mothers less likely to smoke during pregnancy (n=9/9 studies)	African mothers less likely to drink alcohol during pregnancy (n=4/4 studies)	African mothers had lower SES (n=3/3 studies)

Footnote: NR - not reported SD – standard deviation ppweight – pre-pregnancy weight *study reports on two different populations in two HICs

H2: Influence of maternal characteristics on child weight outcomes

Study	(i) Mean Birth weight			
	Factors tested for	**Crude result**	**Adjusted result**	**Interpretation**
David et al. 1997 (523)	Maternal age, marital status, maternal education and parity	Mean BW for African children = 3130g	Difference in mean BW, g Maternal age +146g Marital status +60g Parity +41g Education -26g	Mean BW for African children increased after adjusting for maternal age, marital status and parity Mean BW reduced after adjusting for maternal education
Guendelman et al. 1999 (505)*	Maternal age, marital status, parity, smoking during pregnancy		Difference in mean BW between African and non-African children (SE), g France: 88.6 (22.3) Belgium: 12.8 (0.77)	Mean BW was significantly higher for children of African women after adjusting for all factors
Kelly et al. 2008 (490)	Adjusted for a) Maternal sociodemographic factors: maternal age, parity, pre-pregnancy BMI, smoking during pregnancy) b) behavioural factors: smoking, alcohol consumption c) Education and SES	Mean BW for African children (95% CI) = 3.343 (3.258-3.428) Kg	Adjusted Mean BW (95% CI), Kg (a): 3.193 (2.961-3.425) (b): 3.190 (2.716-3.664) (c): 3.401 (3.030-3.932)	Mean BW for African children decreased after adjusting for maternal sociodemographic factors (maternal age, parity, pre-pregnancy BMI, smoking during pregnancy) and behavioural factors (smoking, alcohol consumption), but increased after adjusting for education and SES
Troe et al. 2007 (513)	Adjusted for maternal age, education, marital status, parity,		Difference in crude and adjusted mean BW in African children (g)	Mean BW increased after adjusting for maternal age and education

Study	(i) Mean Birth weight			
	Factors tested for	**Crude result**	**Adjusted result**	**Interpretation**
	maternal BMI, smoking during pregnancy and alcohol consumption during pregnancy		Maternal age: +30 Education: +43 Marital status: -33 Parity: -37 BMI: -41 Smoking: -24 Alcohol: -22	Mean BW decreased after adjusting for maternal BMI, parity, smoking and alcohol intake during pregnancy
Vahratian et al. 2004 (467)	Adjusted for maternal age, parity, pre-pregnancy BMI, marital status, education and smoking during pregnancy		Difference in mean BW between African and non-African children = +74g	Mean BW was significantly higher for children of African women after adjusting for all factors
Vang et al. 2013 (525)	Adjusted for maternal age, education, marital status, smoking during pregnancy, alcohol consumption during pregnancy		Difference in mean BW = -26g	Mean BW for African children decreased after adjusting for all factors

Footnote: Mean Birth weight (Mean BW); NR - not reported SD – standard deviation

Study	(ii) Macrosomia			
	Factors tested for	**Crude result**	**Adjusted result**	**Interpretation**
Bakken et al. 2015 (515)	Adjusted for maternal age, parity, maternal education and marital status	OR (95% CI) 0.35 (0.19–0.67)	OR (95% CI) 0.33 (0.16-0.66)	Slightly reduced odds after adjustment
Belihu et al. 2016 (521)	Adjusted for maternal age, parity and marital status	OR (95% CI) 0.70 (0.55-0.89)	OR (95% CI) 0.65 (0.5-0.83)	Slightly reduced odds after adjustment
Juarez et al. 2014 (516)	Adjusted for maternal age, education, marital status and parity	OR (95% CI) North Africa: 3.39 (3.19-3.60) SSA: 2.9 (2.50 to 3.36)	OR (95% CI) North Africa: 2.17 (1.98-2.38) SSA: 1.94 (1.65 to 2.28)	Reduced odds after adjustment
Restrepo-Mesa et al. 2015 (517)	Adjusted for maternal age, education, marital status and parity	OR (95% CI) 2.3 (2.2-2.4)	OR (95% CI) 2.0 (1.9-2.1)	Slightly reduced odds after adjustment

Footnote: NR - not reported SD – standard deviation

Study	(iii) Low birth weight (LBW)			
	Factors tested for	**Crude result**	**Adjusted result**	**Interpretation**
David et al. 1997 (523)	Maternal age, marital status, education, parity	RR (95% CI) 1.3 (1.10–1.60)	RR (95% CI) 1.9 (1.5–2.4)	Increased risk after adjustment
Guendelman et al. 1999 (505)*	Maternal age, marital status, parity, smoking during pregnancy	OR (95% CI) 0.67 (0.43-1.07) OR (95% CI) 0.67 (0.57-0.79)	OR (95% CI) 0.60 (0.40-1.10) OR (95% CI) 0.68 (0.60-0.80)	No effect after adjustment
Juarez et al. 2014 (516)	Adjusted for maternal age, education, marital status and parity	OR (95% CI) North Africa: 0.8 (0.77-0.83) SSA: 1.26 (1.16-1.36)	OR (95% CI) North Africa: 0.76 (0.72-0.80) SSA: 1.18 (1.09-1.29)	Reduced odds after adjustment
Kelly et al. 2008 (490)	Adjusted for: (a) Maternal sociodemographic factors: maternal age, parity, pre-pregnancy BMI, smoking during pregnancy) (b) behavioural factors: smoking, alcohol consumption, prenatal care (c) Education and SES	%LBW (95% CI) 9.0 (5.8-13.6)	%LBW (95% CI) (a): 2.8 (1.2-6.4) (b): 8.6 (5.6-13.1) (c): 4.8 (2.6-8.8)	Prevalence of LBW in children of African women reduced after adjusting for all factors
Restrepo-Mesa et al. 2015 (517)	Adjusted for maternal age, education, marital status and parity	OR (95% CI) 0.70 (0.70-0.80)	OR (95% CI) 0.60 (0.60-0.70)	Slightly reduced odds after adjustment

Footnote: NR - not reported SD – standard deviation *study reports on two different populations in two HIC

Appendix H: Publication on African migrant women's dietary and physical activity behaviours

Dietary and Physical Activity Behaviours in African Migrant Women Living in High Income Countries: A Systematic Review and Framework Synthesis

Lem Ngongalah[1], Judith Rankin[1], Tim Rapley[2], Adefisayo Odeniyi[1], Zainab Akhter[1] and Nicola Heslehurst[1]*

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Abstract

Dietary and physical activity behaviours during preconception and in pregnancy are important determinants of maternal and child health. This review synthesised the available evidence on dietary and physical activity behaviours in pregnant women and women of childbearing age who have migrated from African countries to live in high income countries. Searches were conducted on Medline, Embase, PsycInfo, Pubmed, CINAHL, Scopus, Proquest, Web of Science, and the Cochrane library. Searches were restricted to studies conducted in high income countries and published in English. Data extraction and quality assessment were carried out in duplicate. Findings were synthesised using a framework approach, which included both a priori and emergent themes. Fourteen studies were identified; ten quantitative and four qualitative. Four studies included pregnant women. Data on nutrient intakes included macro- and micro-nutrients; and were suggestive of inadequacies in iron, folate, and calcium; and excessive sodium intakes. Dietary patterns were bicultural, including both Westernised and African dietary practices. Findings on physical activity behaviours were conflicting. Dietary and physical activity behaviours were influenced by post-migration environments, culture, religion, and food or physical activity-related beliefs and perceptions. Further studies are required to understand the influence of sociodemographic and other migration-related factors on behaviour changes after migration.

Appendix I: Groups and organisations targeted for participant recruitment; recruitment flyers and social media messages

J1: Groups and organisations through which participants were identified

Organisations and community groups contacted	Social media groups contacted
• North East of England African Community Association (North East) • African Community Advice North East (North East) • Royal African Society (London) • The Africa Centre (London) • African Community Heritage Hub (Birmingham & West Midlands) • African Community Council for the Regions (Birmingham & West Midlands) • British Federation of Women Graduates (UK-wide) • African churches	• Cameroonians in the UK • Nigerians in the UK • Ghanaians in the UK • Black Women's Forum UK • CAMBRIS UK

J2: Flyer used to publicise the study and invite participants

J3: Social media messages

1. Facebook message:

RESEARCH PARTICIPANTS NEEDED!!! - Calling on African women in the UK

We are looking for African women living the UK to participate in an interview or a focus group discussion for a PhD research study on African immigrant women's perceptions on maternal and child overweight and obesity.

Please, contact us and share your views if you:

- Were born in Nigeria, Ghana or Cameroon
- Are between the ages 18-45
- Have lived in the UK for at least 6 months
- Have had a baby within the last 3 years

Contact details
Phone/SMS/WhatsApp:
Email:
Facebook: Maternal and Child Health Research

Thank you in advance for your participation. Please share with your friends and any others who may be interested.

2. Twitter message:

RESEARCH INVITE for African women in the UK to participate in my PhD study on maternal/child obesity. If you're from Nigeria, Ghana or Cameroon; are 18-45 years and had a baby in the last 3 years, please contact me on for more details. Thank you

Appendix J: Participant information Sheet

Newcastle University
Institute of Health & Society

Study title: Perceptions on maternal and child overweight and obesity among African migrant women living in the UK

Invitation
You are being invited to take part in this research study. Before you decide to do so, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and please ask me if there is anything you are not clear about, or if you would like more information on.

What is the background to this research?
Overweight and obesity in women of child-bearing age has serious consequences for both women and children. Although a lot has been published on the implications of maternal overweight and obesity to women and children, much less is known about women's perceptions of the risks to themselves, their children's weights and their infant feeding practices. These have not been explored in African women living in high income countries.

What is the purpose of the study?
This study aims to explore African immigrant women's perceptions, beliefs and knowledge on maternal and child obesity. We want to know your views on maternal overweight/obesity, weight gain before and during pregnancy, nutrition and physical activity during pregnancy, infant feeding and child overweight/obesity. We also want to know how your perceptions or experiences on any of these might be different from those of women in Africa.

Why have I been approached?
For this study I am seeking the views of African women from Nigeria, Ghana and Cameroon, who are between the ages of 18 – 45 years, have lived in the UK for at least 6 months and have had a baby within the last 3 years (children could have been born in or out of the UK). You have been approached because you fit these criteria.

What do I have to do if I take part?
You will be asked to attend either a face-to-face interview which will last up to an hour and a half. During these sessions, all conversations will be audio-recorded and your responses will also be noted.

Interview: The interview will be held at a location that is convenient for you e.g at your home, at the University or any quiet area around your community. The session will be led by a PhD student (Lem Ngongalah).

Do I have to take part?
No, you do not have to take part. Participation is completely voluntary and you are free to withdrawal any time, without any consequences or questions. Any material you have contributed up to the time you decide not to continue will also be withdrawn and destroyed.

Will I receive any payment or monetary benefits?
No, there will be no payment for your participation in this study. Participation is entirely voluntary and your data will not be used for any commercial purposes.

What are the risks involved in this study?
The main risk involved is the fact that the discussions will be around weight and obesity, which are personal and sensitive topics. We will ensure that the conversation is friendly and non-personal; and that you are treated with maximum respect. In addition, all conversations will be kept confidential, only accessible by the research team and solely for the purpose of the study.

Will my taking part in this study be kept confidential?
Yes. Only members of the research team will have access to your data. These will include myself, my supervisors and two research assistants from Newcastle who have been recruited to assist with data analysis. You will only be identified by a unique participant code which will not include any personal identifiable information. All data you provide will be destroyed after the research study has been completed.

How will my information be used?
Personal data will only be used for the purpose of getting in touch in relation to the research (e.g. name and contact details). Background data such as your age and country of birth will be collected prior to the interview for the purpose of assessing eligibility and collating sample data. Your responses will be written up and presented as my PhD thesis. They will also be published in a scientific journal and presented at conferences, while ensuring that confidentiality is maintained at all times.

What if I have concerns about this research?
If at any point you have any questions or concerns about this study, please, feel make contact using the details provided below

Who has reviewed the study?
The study has been approved by Newcastle University Ethics Committeee.

Who can I contact for further information?
For further information on this study, please, use the details below:

Contact information
Name: Judith Rankin
Email: judith.rankin@newcastle.ac.uk
Call: +44(0)191 208 5267

Facebook: Maternal and Child Health Research
Twitter: @MCH_Research

Thank you for taking the time to read the information provided on this sheet which is yours to keep.

Appendix K: Consent form for qualitative study

Newcastle University
Institute of Health & Society

Consent form

Study Title: Perceptions on maternal and child overweight and obesity among African migrant women living in the UK

Please read and complete this form carefully. If you are willing to participate in this study, please print your initials next to the appropriate responses, then sign and date the declaration at the end. If you do not understand anything and would like more information, please feel free to ask.

I, the undersigned, confirm that (please, print your initials as appropriate):

		Initial
1.	The research has been satisfactorily explained to me and I have read and understood the information about the study, as provided in the Participant Information Sheet.	
2.	I understand that the research will involve an interview lasting up to an hour and a half, which will be audio-recorded	
3.	I understand that an external transcription company may be used to transcribe the data for this study	
4.	I have been given the opportunity to ask questions about the study and my participation.	
5.	I understand that my participation in this study is voluntarily	
6.	I understand that I can withdraw at any time without giving reasons and will neither be penalized nor questioned for withdrawing	
7.	I understand that all information about me will be kept and treated confidentially; and only researchers who are part of this study and who agree to the terms on this form will have access to my data	
8.	The procedures regarding confidentiality and the use of my data in research, publications, sharing and archiving have been clearly explained to me	
9.	I understand that all audio tape material I provide will be used solely for the purpose of this study and will be destroyed upon completion of the research	
10.	I freely give my consent to participate in this study	

Participant:

Name of Participant _____ Signature _____ Date _____

Researcher:

Name of Researcher _____ Signature _____ Date _____

Appendix L: Excerpts of coding of data from interviews

L1: Sample excerpt showing analysis of data on women's weights

Interview extract	Codes	Common emerging concepts	Overarching themes
Q: So would you say obesity is something you would commonly find among African women? **R:** *Ermm… no. It's not a common problem for Africans to be obese. Don't get me wrong, we can be fat but not to the extreme like obese people. It's true that some of us can be overweight and maybe we don't even know, but obese, I'm not sure. It's very rare…I won't say obesity is one of our problems.. It's not something that African people are -- like you won't hear them saying oh I'm worried that I'm obese or something like that. We have other problems na… (laughs) If you see an African woman who's complaining that she's overweight, then surely she's been hanging around with a lot of errr…a lot of people who are not African…and sometimes – sometimes also because she has been in the UK for a while and you know here, you hear a lot about obesity because it's a common problem for them.. But also even if we start getting fat or overweight, we still don't see it as a problem because it's like a sign of good living for us. We don't like skinny people (laughs)… it's not like we want people to be very fat or obese…we just like when a woman looks healthy* **Q: I see. Can you please describe for me what a healthy woman would look like?**	Obesity is not a problem Acknowledgment that African women could be overweight Understanding of obesity as extreme fat Possibility of not recognising overweight status Obesity is not common in Africans Migrant interactions contributing to changing weight perceptions after migration Duration of residence in the UK contributing to changing weight perceptions after migration Greater exposure to messages about overweight and obesity after migration Obesity is more common in the UK	**Commonly held beliefs about obesity** • Obesity is not a problem • Obesity is not common in Africans • Obesity is more common in the UK • Acknowledgment that African women could be overweight **What obesity looks like** • Understanding of obesity as extreme fat • Possibility of not recognising overweight status **What causes obesity** • Uncontrolled eating as cause of obesity • Blaming people with obesity for lacking self-control • Acknowledgement that it's not easy to lose weight	**Everyday perceptions on susceptibility to and causes of obesity and overweight**

R: *Well, you know, when she looks a bit chubby, like when she's thick and there's some flesh. Let me use myself as an example, I used to be slimmer before…I used to be around…let me see that picture again…yes I used to be around size B and my mum she was always complaining that I'm so small and she really wants me to put on weight. She and my husband, they would say -- she used to say like after I got married she was saying if I don't put on enough weight then I won't have the energy to carry my baby when I'm pregnant so I don't know maybe it's true or not, but mum is very happy with my size now, I'm around size D now like I said earlier and hubby is also very happy*

Q: Right, I see. What about you? Are you happy with your size now?

R: *Me I still want to lose weight oh! Even though when I mention it they're asking me if I'm normal (laughs) my sister can just kill me with her eyes when I say that, but me I want to be smaller than this please..*

Q: Any particular reason why you want to be smaller?

R: *Not really, I just want to be more fit. Plus, I feel that this place can really make you fat.*

Q: How so? Why do you say that?

R: *when you're back home, you eat more healthy and there are more things that you can do to stay active. But when you come here, it's like junk food upon junk food, bad weather, so you're not really eating healthy and you're also not very active, so it's easy to get fat. But I'll also say this, for me, it's all about control. People who get very fat like that, means they – it's somebody who is without control. I know that it's not easy to lose weight or to stay within a certain weight*

Preference for bigger body size

Societal preference for big body size

Dislike for skinny people

Healthy woman should be 'chubby' and 'thick'

Increase in weight status

Family members influencing weight gain

Desire to be smaller in size

Eating healthier back home

Back home more conducive to PA

UK obesogenic environment

Blaming people with obesity for lacking self-control

Acknowledgement that it's not easy to lose weight

Uncontrolled eating as cause of obesity

Preference for bigger body size

- Preference for bigger body size
- Dislike for skinny people
- Healthy woman should be 'chubby' and 'thick'

Influences on weight preferences

- Family members influencing weight gain
- Societal preference for big body size

Changing dietary and PA behaviours after migration

- Eating healthier back home
- Back home more conducive to PA
- UK obesogenic environment

Bigger is better

Acculturation of weight-related behaviours and influences

but some people just don't care, they just eat anyhow and before they realise it's already too late and you're struggling to lose the weight.		**Changing weight perceptions after migration** • Desire to be smaller in size • Migrant interactions contributing to changing weight perceptions after migration • Duration of residence in the UK contributing to changing weight perceptions after migration • Greater exposure to messages about overweight and obesity after migration • Increase in weight status	**Acculturation of weight perceptions and influences**

Footnote: Q: Question; R: Response

L2: Sample excerpt showing analysis of data on child weight

Interview extract	Codes	Common emerging concepts	Overarching themes
Q: …and how about children, would you say it's common to find African children who are overweight or obese? **R:** *I…I don't think so, I won't say it's common. It's true that there can be some children who are growing maybe a bit bigger than their age but that doesn't mean they have a weight problem. Maybe they just grow faster than other children. That doesn't mean they're overweight or obese. And also you won't find that many [African children] who are bigger than their age. Most of them have normal weight.* **Q: So would you at any point consider a child as being overweight?** **R:** *Ermmm, maybe from a certain age, like when the child starts talking or walking or eating real food but not when they're babies. We all want our children to be healthy, and you can't really say a baby is too fat because babies change very quickly so a baby can look so big today, tomorrow the baby looks smaller so I don't think within the first few months you can really say that a baby is overweight.* **Q: Okay, thank you. Now, let's talk about your son a little. How would you describe his size?**	Overweight/Obesity is not common in African children Acknowledgment that African children could be bigger than their age Denying risk of overweight or obesity in children Child can only be overweight from a certain age A baby cannot be too fat Mothers desire to have a heathy child Babies change very quickly as they grow Admiration for chubby babies Admiration for bulky babies Admiration for round-looking babies Child looks bigger than their age Big=healthy Child weight status = overweight Desire for child to gain weight	**Commonly held beliefs about child weight and obesity** • A baby cannot be too fat • Child can only be overweight from a certain age • Acknowledgment that African children could be bigger than their age • Child being too big is not a problem • Overweight/obesity is not common in African children • Denying risk of overweight or obesity in children	**'A child cannot be too fat'**

R: *My son is really tall and bulky, and he has some cute chubby legs…People always say that he looks bigger than his age.*

Q: How does it make you feel when people say he looks bigger than his age?

R: *How does it make me feel…I think it's a good thing because it shows he's growing well and he's healthy. I like chubby babies. Which mother doesn't want her child to look healthy?*

Q: By healthy you mean…
R: *I mean like bulky, you know, those round, cute-looking babies that you just want to carry. Like my son, he's a really chubby little boy, and people just love him*

Q: Oh I see. Can you please show me what his size looks like from these images?
R: *He's er… he's around number 6*…yeah, 6*.*

Q: Okay. And are you happy with him being that size or would you have preferred another?
R: *Hmmm (laughs) honestly, I want him to be a bit bigger. Just a bit, like in between 6 and 7**, somewhere there.*

Q: Okay, why is that? Why do you prefer that size?
R: *Well, like I said, I like chubby babies. Also you know sometimes people judge the way you take care of your kids from how healthy they look….*

Child size as measure of parental care-taking

Child being too big is not a problem

Children lose weight as they grow

Activities through which children lose weight as they grow

Family influences: grandmother wants child to be big

Disregard for HCP advice on child weight management

Baby fat

Child being happy and active as determinants of their health

Child weight preferences

- Admiration for chubby, bulky and round-looking babies
- Desire for child to gain weight

Influences on child weight preferences

- Mothers desire to have a heathy child; big=healthy
- Child size as measure of parental care-taking
- Family influences: grandmother wants child to be big
- Baby fat idea
- Children lose weight as they grow
- Activities through which children lose weight as they grow
- Child being happy and active as determinants of their health

Disregard for HCP advice on child weight management

'A healthy child'

Q: What do you mean? Can you explain that for me please? **R:** I mean if your child is too small it comes across like you're not taking proper care of him…but if your child is too big that one is not really an issue because they will lose the weight when they're growing you know, when he starts crawling and running around he's being active, he's playing, the weight is going to go (…) so it's better to have a healthy child and then when the child is growing up he gets smaller **Q: I see. And what about your family members, do they also want him to be a bit bigger?** **R:** *My family sees almost the same..anytime my mom comes here she's like has he eaten, how many times did you feed him today what did you give him are you sure he's not hungry things like that. So it's the same thing she wants her grandson to be big and look healthy. But some of my friends tell me that he's putting on much weight… even the health visitor was also telling me some things to do, advising me that I need to regulate his diet, bla bla. But I don't want him to reduce, so I didn't do anything that she said. (…) it's just baby fat. As long as he's happy, he's very active so… I'm not bothered about his weight*			

Footnote: Q: Question; R: Response; *Number 6 corresponds to child overweight silhouette (see Chapter 7 Figure 27); ** Number 7 corresponds to child overweight silhouette (see Chapter 7 Figure 27); HCP – health care provider.

Appendix M: Ethics approval letter

15 November 2018

Faculty of Medical Sciences
Newcastle University
Medical School
Framlington Place
Newcastle upon Tyne
NE2 4HH

Lem Ngongalah
Institute of Health & Society

FACULTY OF MEDICAL SCIENCES: ETHICS COMMITTEE

Dear Lem,

Title: Knowledge, beliefs and perceptions on maternal overweight/obesity, child overweight/obesity and infant feeding among African migrant women living in the UK
Application No: 1619/7864/2018
Start date to end date: 01/11/2018 to 01/02/2020

On behalf of the Faculty of Medical Sciences Ethics Committee, I am writing to confirm that the ethical aspects of your proposal have been considered and your study has been given ethical approval.

The approval is limited to this project: **1619/7864/2018.** If you wish for a further approval to extend this project, please submit a re-application to the FMS Ethics Committee and this will be considered.

During the course of your research project you may find it necessary to revise your protocol. Substantial changes in methodology, or changes that impact on the interface between the researcher and the participants must be considered by the FMS Ethics Committee, prior to implementation.*

At the close of your research project, please report any adverse events that have occurred and the actions that were taken to the FMS Ethics Committee.*

Best wishes,

Yours sincerely

M. Holbrough

Marjorie Holbrough
On behalf of Faculty Ethics Committee

cc.
Professor Daniel Nettle, Chair of FMS Ethics Committee
Mrs Kay Howes, Research Manager

*Please refer to the latest guidance available on the internal Newcastle web-site.

Appendix N: Participant debriefing sheet

Study Title: Perceptions on maternal and child overweight and obesity among African migrant women living in the UK

Researcher: Lem Ngongalah (PhD Student, Newcastle University)
Supervisors: Judith Rankin, Nicola Heslehurst, Tim Rapley

Thank you for your time participating in this study. Due to the sensitive nature of the topics discussed, please take the time to read through this debriefing sheet.

Please be reminded that your responses are anonymous and will be kept confidential at all times.

If you require any support following the topics discussed, you can contact your GP who will be able to offer some advice. You may also contact your local council, as they will be able to offer information or advice on obesity management; or refer you to other professionals for support.

If you have any complaints about the research, please direct them to Elaine McColl, Postgraduate Research Student Coordinator for the Institute of Health and Society using the following details:

Phone: **Email:**

Address: Institute of Health & Society, Newcastle University, The Baddiley-Clark Building, Richardson Road, Newcastle upon Tyne, NE2 4AX.

Thank you.

If you have any queries or comments or wish to pass on any further information please contact:

Lem Ngongalah
PhD Student
Institute of Health & Society
Newcastle University

Judith Rankin
Institute of Health & Society
Newcastle University

Nicola Heslehurst
Institute of Health & Society
Newcastle University

Tim Rapley
Department of Social Work, Education & Community Wellbeing
Northumbria University

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